THE CONNECTICUT SOCIETY OF CIVIL ENGINEERS

INCORPORATED

1923

The Connecticut
Society of Civil Engineers

Incorporated

Papers and Transactions for 1923

AND

Proceedings

OF THE

Thirty-Ninth Annual Meeting

AT

HARTFORD, FEBRUARY 20 AND 21, 1923

Published by the Secretary

New Haven
THE TUTTLE, MOREHOUSE & TAYLOR COMPANY
1923

The Connecticut Society of Civil Engineers,

Incorporated

ORGANIZED AT BRIDGEPORT, JANUARY 15, 1884

Officers for 1923

ALFRED H. TERRY, Bridgeport .... *President*
LEON F. PECK, Hartford .... *First Vice President*
CHARLES W. EDDY, Waterbury .... *Second Vice President*
CLARENCE M. BLAIR, New Haven .... *Secretary and Treasurer*
BERTON SHOOK, Bridgeport .... *Assistant Secretary*

Directors

HAROLD L. BLAKESLEE .... New Haven
Term expires February, 1924
VINCENT B. CLARKE .... Ansonia
Term expires February, 1925
E. IRVINE RUDD .... Glenbrook
Term expires February, 1926

Past-President
(*Member of the Board*)

ROBERT J. ROSS .... Hartford

Committees

Meetings—ALBERT L. DONNELLY, New Haven .... *Chairman*
Membership—LAFAYETTE E. EVANS, Bridgeport .... *Chairman*
Papers—HERBERT C. ELTON, Bridgeport .... *Chairman*
Public Affairs—CALEB M. SAVILLE, Hartford .... *Chairman*

CONTENTS

LIST OF EX-PRESIDENTS

WITH DATES OF SERVICE

*B. Hull	1884, 1885
*Charles M. Jarvis	1886
Charles E. Chandler	1887
*Charles H. Bunce	1888, 1889
*F. Floyd Weld	1890
E. P. Augur	1891, 1892, 1893, 1894
Wm. G. Smith	1895, 1896
Robert A. Cairns	1897, 1898
Edwin D. Graves	1899, 1900
Henry J. Kellogg	1901
*Clarence B. Vorce	1902
Frederick L. Ford	1903
John K. Punderford	1904
Albert B. Hill	1905
Charles F. Chase	1906
*Daniel S. Brinsmade	1907
Edward W. Bush	1908
Frederick J. Easterbrook	1909
Shepard B. Palmer	1910
Charles A. Ferry	1911
A. William Sperry	1912
Sheldon E. Minor	1913
George K. Crandall	1914
Charles C. Elwell	1915
Clarence Blakeslee	1916
Henry R. Buck	1917
William R. Dunham, Jr.	1918
Charles J. Bennett	1919
Thomas A. Scott	1920
J. Frederick Jackson	1921
Robert J. Ross	1922

*Deceased

PRESIDENT'S ADDRESS*

Robert J. Ross, Asst. City Engineer, Hartford, Conn.

The By-Laws of our Society decree that at this time you are to listen to an address by your President; or, perhaps more correctly stated, the By-Laws call for an address, but it is really not compulsory on your part to listen. The fact, however, that we are all Civil Engineers assures me of reasonable courtesy on your part and gives me courage to proceed.

For to-day and to-morrow it would seem that there is no good reason why the affairs of our Society should not be properly looked after because you have just elected a new President, and your old President's responsibility does not end until the adjournment of this, our Annual Meeting.

The arrangement whereby the outgoing President must sing a Swan song instead of the incoming President delivering an address is fair enough since the President who is just finishing his term has a whole year as President to look back upon, and should therefore have facts and figures to work on, while the incoming President cannot do much more than promise and we have all learned not to give the weight to office seekers' promises which in some cases may be warranted. I might add, however, that I have no apprehension about our new President making good on any promises he may make, so I hope he will make many, and I feel that the Civil Engineers of Connecticut are fortunate in their selection of Mr. Terry to head our Society for the coming year.

During the past year conditions as affecting the engineers of the State have been more nearly normal than has been the case for a considerable period, and engineers in common with others have settled down to a healthy, natural programme of endeavor to the mutual benefit of themselves and their Country.

Much has been said in the past relative to the lack of appreciation of engineers, both as to their comparatively small compensation, and to their not holding the position in society to which they are justly entitled. I believe that there has been a steady improvement along these lines for sometime back and specially

* Presented at the meeting of February 20, 1923.

since the importance which engineers played in the war was brought so forcibly to the attention of all the world.

The cause is largely due to the fact that the accomplishments of engineers are apt to be taken for granted and are so necessarily a part of our every day life that little thought attaches to them:— For example, people will gaze at a building which touches the clouds and be impressed that it is some high but will hardly give a thought to the achievement from an engineering standpoint which it exemplifies. In this same towering structure, passengers will step into an elevator to be transported twenty, thirty, or more stories with no apprehension as to their safety, and will enjoy the same comforts as to health and convenience on every floor from the bottom to the top.

The traveling public will enter a subway and be transported for miles beneath the surface, passing under built up sections of cities and extensive bodies of water with more confidence than they would have on the surface of a congested thoroughfare.

Mighty bridges are built to cross our largest streams with spans of almost unbelievable length and millions of people use them daily with the utmost safety and as a matter of course.

Bountiful supplies of pure wholesome water are brought to our cities from sources in the hills miles away, and the wastes of our centers of population are removed with every safeguard to the health and comfort of our people.

The better modern pavements are the work of engineers and are designed and built to last until the date of their installation is but a recollection.

The tremendous energy of falling waters is harnessed and transported great distances to centers where it can be put to work for the benefit of mankind. And the engineer has been the man behind the gun in all of these accomplishments.

I could continue indefinitely to emphasize the importance which attaches to engineers, whether they be civil, mechanical, electrical, chemical or engineers of allied branches, and even then the story would be but half told. It would be difficult to say which branch of engineering is making the most rapid advancement, but certain it is that all are making strides such that it is hard to keep up with them.

'Tis said that it is love that makes the world go 'round, but I

haven't the least doubt but that, if it should stop revolving, engineers would be expected to, and would, find means to start it going again and to keep it going as in the past.

We should not engage in idle boasting, but, on the other hand, we need not be too modest, for we know, and it is but just that the people should appreciate, that in a large way it is the engineer who finds a way when old conditions must be improved upon; also that while capitalists or governments may appear courageous in advancing the necessary funds for gigantic enterprises, they would not do so except for the confidence which they have in the engineers, on whose genius and resources they are banking.

If the profession of engineering continues to make the advancement which it has been making, if we see to it that the credit falls where it is due and if we all live up to the ethics of our calling, I have faith that our future for the engineer may be looked forward to with confidence and assurance.

The engineering periodicals which are so moderately priced that they are within the reach of all are excellent mediums for keeping posted on what the other fellow is doing and how he does it, but, capital as these publications are, they lack the personal touch which members in organizations like ours experience when brought together.

Our summer outing is primarily for the fun of the thing, to get together and renew acquaintances, and it serves its purpose well, but at all other meetings I feel that it is perfectly proper to "talk shop" and swap experiences, and there should be no hesitancy on the part of any member to ask brother members for their opinion or advice on subjects in which they are mutually interested.

There is often too much duplication of experiments. Much of this duplication could be avoided, valuable knowledge gained and considerable money saved from the experience of others, if we would only look to our neighboring engineers and avail ourselves of the benefit of their experience.

But you can't know your brother engineers if you don't make a reasonable effort to keep in touch with them and there is no better way to do this than by attending the monthly meetings as well as the summer and annual meetings of the Connecticut Society of Civil Engineers. From the standpoint of good meetings held I feel that we have had a very successful year. An attempt has been

made to cover every section of the State in these meetings and no locality has cause to feel slighted. Besides the annual meeting here in Hartford which is now in session and the summer outing at the Connecticut Agricultural College, we have held six meetings of which the Chairman of Meetings will speak in detail.

The summer outing at Storrs was a big success, which proves that our field day does not have to be held at the seashore to be popular. From the standpoint of the members in attendance this meeting equalled any in the Society's history. Much credit and thanks are due President Beach of the College, Professor Dodge, Professor Wheeler and their capable allies, for our royal welcome and fine treatment.

Our meeting which is now in session should prove interesting and instructive. Some of the talks, while perhaps not strictly along civil engineering lines, are of importance to every one of us, and, as a matter of fact, it would be impossible to draw the line or limit the fields in which engineers are interested, for our profession is becoming one of the most diversified callings imaginable.

Our meetings and our Society itself could not be a success but for the loyal support of its members and the hard work of individuals who have given of their time and energy with results which speak for themselves.

I would be remiss in my duties if I did not acknowledge the credit which is due these various members and others who have lent a hand, and I do so now without, however, attempting to enumerate the long list of names.

Mr. Rudd, chairman of the committee on meetings, deserves special mention, for it is due primarily to his individual effort that we have had so many successful meetings. His work and that of Mr. Peck, who is chairman of the committee on papers for this meeting, cannot be spoken of too highly.

The Society's year book has been printed and distributed to the membership, and I trust that our finances will be such that it may never again be necessary to omit our publication.

Our Society is growing steadily and we can now boast of a membership of over 500. Of this number thirty have been admitted this year. We are glad to welcome these new members to our ranks and trust that they will find their membership both profitable and interesting.

The question of affiliating with other engineering societies has been in the air for some time past and you will have an opportunity to discuss the issue presently. While it is an open question, and one which should be decided by the Society as a whole, I feel that the success of our Society has been such that we can bank upon remaining a healthy, live organization, and it is not absolutely essential that we affiliate in order to continue successfully.

To have served you as President has been a pleasure, an honor, and a privilege which I deeply appreciate and for which I feel truly grateful. I congratulate our new President on the opportunity which is his:—I wish him a successful year and the Society successful years without number.

A "NEW ST. LAWRENCE"*

By Col. Hugh L. Cooper, Consulting Engineer, New York City.

The subject we are to discuss to-day is one of such great interest to the citizens of Connecticut as to require care on my part if the time limit at my disposal is not exceeded, and I promise you at the outset that I will not detain you one minute beyond the allotted hour.

Let me first express my indebtedness to you for this long desired opportunity of addressing a Connecticut audience on the New St. Lawrence proposal. The New St. Lawrence will have an especial appeal to you because a New St. Lawrence, as I shall attempt to later show, will have an important bearing on the future prosperity and happiness of Connecticut.

The Frontier Corporation for whom we have done the engineering investigation on the St. Lawrence, was formed solely for the purpose of getting behind the movement for a New St. Lawrence, and serving the idea in whatever capacity seems best in the public interest.

We are not here to-day to ask you to endorse any engineering plans you will be shown, or to pass upon the question of government ownership versus private ownership under strict public service regulation as to rates and service. We are here, however, to briefly picture to your minds two great industrial possibilities and to tell you how we think your society should assist in securing these industrial helps, if I succeed in convincing you that you should take off your coats and work for a new St. Lawrence.

It is my purpose to first describe in a non-technical way the project as I see it and to tell you roughly what it will cost, and then to tell you why, in my judgment, it should mean much to the people of Connecticut.

I sometimes regret that I have not a drop or two of the blood of Demosthenes in my veins, because we will deal with a situation of such scope and magnitude as would inspire any man to great efforts who was gifted in the art of public speaking. In no spirit

* Presented at the meeting of February 20, 1923.

of apology I must tell you that oratory passed me by; on the other hand I am comforted by the knowledge that plain facts plainly spoken are all that you expect from me.

Now what do we mean by a "New St. Lawrence"? I mean taking the existing St. Lawrence River and reconstructing it in such a way as to develop it to its maximum efficiency for navigation and power for the use of the greatest number of people in Canada and the United States.

It will help us if we begin with a brief outline of what the present St. Lawrence River is really like.

The St. Lawrence with its tributary lakes and rivers contains more than half of the fresh water on this entire globe.

This is the first big thought that I want you to keep in mind, because we can not think intelligently with respect to this problem if we fail to visualize its broad magnitude and thereby fail to compose a successful understanding of it.

By a New St. Lawrence we mean the reconstruction of the St. Lawrence as it now is from the head of the river just above Gallop Rapids to Montreal, a distance of 120 miles, in which the St. Lawrence drops 220 feet. In this stretch of the river there now exists navigation for boats not exceeding 260 feet in length and 43 feet beam, and drawing not more than 14 feet of water. The present tonnage over this stretch of the river is about 4,500,000 tons a year. In this district there are now installed four hydro-electric power plants developing about 300,000 horse power.

The St. Lawrence at Montreal, before the entrance of the Ottawa River, drains 200,000 square miles of territory on which the rain falls and is gathered into the five Great Lakes having an area of 90,000 square miles.

These are indeed quantities of majestic magnitude and they represent the greatest natural idle resource on the earth. The time has arrived when more than fifty million people in Canada and the United States need this tremendous resource, to provide navigation and power of a character and magnitude that can not possibly be otherwise secured. Healthy, growing industry and its happiness on both sides of the boundary between Canada and the United States must halt until a New St. Lawrence is constructed and in commission.

I desire to specially reiterate our belief that navigation is now and always will be first in importance as compared with power.

For a long time, in some quarters, any private interest that has been found studying the New St. Lawrence has been unjustly accused of interest in power only, and your speaker has been particularly referred to as opposed to navigation. Nothing could be further from the truth. The gentlemen behind the Frontier Corporation have too much intelligence to think for a moment that a river such as the St. Lawrence, that is capable of handling over 100,000,000 tons of freight a year, is in the slightest degree to have this great navigation possibility subordinated to power. Any investment based upon a plan of such subordination would of itself be unsafe and unpatriotic and would, of course, never be undertaken.

For my part, I have recommended navigation plans for the St. Lawrence, which are said by experienced Lake Steamship men to be considerably superior to the plans prepared by the Engineers of the International Joint Commission, and I am sure my plans can be greatly improved by other experienced engineers. I yield to no one, however, in my zeal and earnestness of effort for sane navigation. Now they tell us in many quarters that seven months navigation for ocean vessels is impracticable. This claim I discard, because we are living in a time when the impracticable of to-day is practicable to-morrow.

From 1885 to 1912—only twenty-seven years—the boats on the Great Lakes have increased over five times in tonnage, and the rate of unloading is now accomplished in one-fifteenth of the time required in 1885.

With any such record in marine engineering, who will be justified in saying that our marine engineers, given a 30-foot channel to operate in and 100,000,000 tons of possible freight a year to be moved, will not be equal to the design of a new type of steamer that can economically and profitably operate the fresh and salt water on reduced rates, that will be of great advantage not only to the West, but to the entire country?

I happen to know that one of the greatest shipbuilding concerns in America is of the opinion that such a new type of vessel is already possible, and I have no doubt that other shipbuilding concerns will reach the same conclusion as and when a New St. Lawrence is in sight.

I believe the time is now at hand when navigation on the Great Lakes and the St. Lawrence can and should be undertaken on a big, broad scale, not only for the benefit of the farmers of the West, but for the benefit of all bordering cities and finally for the benefit of the railways themselves. Everyone with any sense knows that the railways for many years to come will not have the capacity required for transportation demands upon them, and any relief in these transportation demands that can be sensibly provided will be of great help to the railways and shippers alike.

Now as to power. I desire first to describe the value of power, and after that to tell you how I think these values will be eventually secured.

Our studies show that the maximum of efficiency in navigation and the maximum of efficiency for power can be secured without the sacrifice of an inch of navigation or the sacrifice of a single horse power. The history of engineering does not reveal a case where two such great resources can be constructed with such harmony toward one another as exists on the St. Lawrence River, with respect to navigation and power.

Now as to how the power is to be created and its blessings, and blessings it can bestow when created.

It is proposed to make the first development at Cat Island, near Messina, with an installation of 1,200,000 horse power.

Four other installations will be made between Cat Island site and Montreal, and the resulting five installations will create 5,400,000 horse power for commercial use in the United States and Canada; 1,200,000 horse power for the United States and 4,200,000 horse power for Canada.

Now let us consider a part of the benefits that will flow from the construction of 5,400,000 horse power in the territory that can be served—and I am sorry that we have not the time available for setting forth all of the benefits that could be enumerated.

Five million and four hundred thousand horse power is more hydraulic power than is now in use in Europe, outside of Norway and Sweden, and means the saving of 54,000,000 tons of coal annually.

It now requires a freight train of fifty-ton cars 9,000 miles long, and the use of 170,000 men to mine, handle and transport this coal to its ultimate ash pile.

Five million and four hundred thousand in horse power means

a saving of $190,000,000 annually in the power bills of industry now using coal. This saving will increase in the future as the cost of labor and transportation increases, as we all know it certainly will increase.

A saving of 54,000,000 tons of coal annually means the release of $550,000,000 of existing railway property for other more profitable use, and this at a time when our railways for years to come, through no fault of their own, will be sadly inadequate as freight carriers.

If the time permitted, I could enumerate many more blessings that would result from a New St. Lawrence.

There now remains time only for two or three concluding ideas that I want to touch briefly upon.

Progress in hydraulic engineeering is now such that the cost of power at the generating stations along the St. Lawrence will be less than present day station costs at Niagara Falls, in either privately or governmentally owned plants.

History does not record a single instance where any nation was ever continuously prosperous at the expense of a neighboring nation.

I hear from time to time narrow-minded people saying that the New St. Lawrence will be of more benefit to Canada than it will be to the United States. This is not in any sense true, for the first great reason that we in the United States have over forty millions of people who will be benefited by the reduced freight rates, due to lake and river navigation, as compared to ten millions of people enjoying such benefits in Canada.

From the standpoint of power, Canada will receive 4,200,000 horse power as compared to 1,200,000 horse power that will belong to the United States. A part of this 4,200,000 horse power going to Canada can be used in the United States for many years to come, according to mutually satisfactory terms that can be worked out for such a plan between Canada and the United States. Just what these proportions will eventually be will have to be determined by the State Departments of the respective countries. But independent of the navigation situation and independent of the actual ratios of distribution of the power created, there is a far greater reason why we in the United States will be enormous beneficiaries through any increase in the pros-

perity and population of Canada. You men here in Connecticut know that your business in Canada, direct and indirect, will increase in direct ratio with the population in Canada. Twenty-five million people in Canada will be of far greater value to industries of the United States than ten millions.

We are living in a great industrial age, and one of our outstanding needs is foreign commerce, and Canada is now one of our best markets and can easily be made our best market, if we do not act in a narrow and foolish manner every time the question of reciprocity with this country comes up for consideration.

The latitude of Canada is such that in a general way her production can never compete and interfere with our production, and the disposition of her natural resources fits in very practically with our natural resources in such a way as to make possible the freest interchange of manufactured products between these two great countries.

If we can in America aid Canada in her upward march in population and industrial wealth, by helping her to benefit by this new navigation and extra power, we are helping ourselves just as much as we are helping Canada.

Now and again we hear that the State of New York is opposed to a New St. Lawrence because it might hurt the Port of New York and the Erie Canal. I am here to tell you that the most intelligent men in New York are for a New St. Lawrence. It is only the misinformed in New York that are opposed to a New St. Lawrence.

In addition to the material side of this question, there is a great moral side of this question. I think everyone, especially since the Great War, and Canada's magnificent record in the war, is of the opinion that Canada and the United States each should do everything to cultivate the closest friendly relationship, and this idea can be helped forward tremendously if the people in the United States will look at the New St. Lawrence in a perfectly sane way, and not be influenced by petty politics and personal selfishness.

Now as to the question of the cost of the St. Lawrence. You men of business are familiar with the fact that one of the most difficult things in the world to-day is to find out the true cost of anything. Our good friends in the governments of Canada and the United States have the idea that interest on the investment

should never be included in the cost of public works. We all know that this is a false premise, and that if we figured along these lines in private life we would go to the wall in a short time.

As showing the extent to which the public are misled as to the truth about our money matters, let me tell you that the Panama Canal was estimated originally to cost $144,000,000, that when it was finished the principal cost was around $300,000,000, but the actual cost to-day of this magnificent structure is over $625,000,000 when we add the interest we taxpayers have already paid. And yet we have distinguished gentlemen telling us that the Panama Canal is already earning a profit because the tolls exceed the cost of operation of the canal, but no part of the interest charges are included in the cost of operation.

Now as to the cost of the New St. Lawrence. The engineers of the International Joint Commission spent about a year of hard work preparing a set of plans and an estimate based thereon that would show the cost of the work as they had designed it.

The amount of funds available for the use of the government engineers was miserably small and insufficient.

The estimated cost as arrived at by the government engineers for the installation of a capacity of 1,850,000 horse power in the international section, and for the construction of a canal 25 feet deep, with locks and structures for 30 foot of depth, in the international section of the river to Montreal, the total estimate was $252,700,000.

For the completed project for navigation and power the government engineers' estimates call for the installation of a power capacity of 4,545,000 horse power and a 30-foot navigation between Montreal and Lake Ontario, to cost the sum of $506,000,000.

My objection to this estimate of $506,000,000 is founded on several important factors:

In the first place, navigation is not efficiently developed.

In the second place, no interest on the investment was charged either during the construction period or during the power loading period.

Third. The designs which they hastily worked out are believed by many engineers to be, not only unsafe as far as ice pressures are concerned, but from a water power standpoint, the power

produced would have little, if any, value because the plants would be forced to shut down in a large part during every winter season.

My fourth objection to this plan of the government engineers lies in the fact that more than 850,000 horse power would be thrown away, as compared to an efficient use of the latent power in the St. Lawrence River.

I have roughly estimated that the total cost of $506,000,000, as estimated by the government engineers, would be eventually more than double this amount when the final plans were approved by the technical board which will have to be appointed for this great work.

I wish, however, to assure you that, in my opinion, even if the work does cost well over a billion dollars, I am very certain that the value of the results will more than justify the greater figure.

No one will ever be found who can successfully criticize the final true cost of this work, if the values of navigation and power to the public are properly developed.

I desire also to express my opinion that when the final show-down as to the best plan is made before the International Joint Commission and the new technical board of advisers which the Commission has asked for, takes place, you will find that several well organized interests of private capital will be competing before the governments of Canada and the United States for the rights to carry this great project through, according to the recommendations of the technical board of advisers whatever these recommendations are.

We now come, naturally, to the question of public ownership versus private capital ownership. This is indeed a question of such magnitude that it is perfectly idle to try to even glance at it to-day.

This question of public ownership versus private ownership and all other questions regarding the New St. Lawrence should be settled by a Government Fact Finding Commission of the same high character as is represented by President Harding's Fact Finding Commission now at work on our coal strike problems.

When Mr. Harding's Fact Finding Commission is through we know in advance that the public will for the first time know the truth of both sides of this vexed coal question. When the truth

is in hand, the public will have little difficulty in understanding and accepting the recommendations of the Harding Commission as they are made to the Congress.

Truth is most difficult of discovery and establishment. Practically every great outstanding difficulty in the world to-day is the result of ignorance, and in my humble opinion out of all of the causes of the recent Great War, the greatest one was human ignorance.

What we need with respect to the St. Lawrence is to get rid of the ignorance that is now in evidence on this great question. In my opinion, the best way to get rid of this ignorance is to have the governments of the United States and Canada establish a high-grade Fact Finding Commission, whose job will be to separate the wheat from the chaff in this problem and make specific recommendations to their respective governments as to the plans that should be followed in the development of this great resource. Let such a tribunal advise Congress as to whether public or private ownership is best. Let such a tribunal advise Congress whose engineering plans are the best.

In March, 1919, now almost four years ago, Congress requested the International Joint Commission to investigate the question of a New St. Lawrence, and in January of the following year the governments of the United States and Canada did refer the New St. Lawrence problem to the International Joint Commission. The International Joint Commission in December, 1921, submitted its report to the Departments of State of the United States and Canada. On page 180 of the International Joint Commission's report are these words:

"Finally, the Commission is strongly of the opinion that the subject matter of this investigation is one of such extraordinary importance to the peoples of the two countries, and involves engineering problems of such magnitude and diversity, that no effort should be spared to secure a plan which will beyond all reasonable doubt obtain from the Upper St. Lawrence its maximum efficiency in navigation and power. To this end the Commission believes that, before any particular scheme is finally adopted, all the available engineering data, including the report and plans of the engineering board and all comments thereon or alternative plans, should be referred to a special technical board for careful consideration and report."

The trouble with this recommendation of the International Joint Commission is that the governments receiving these recommendations have not appointed the special technical board the

Commission has so wisely asked for. In spite of everything that has been done to forward this end by the Great Lakes-Tidewater Association and everybody else in Canada and the United States interested in navigation and power from the St. Lawrence, the governments of Canada and the United States have failed to show any interest or leadership that gives any promise to build a New St. Lawrence.

If I should go down to Congress and talk to these people, the first thing that comes to their minds, though they do not always necessarily say it, is this, "Oh, Cooper represents a lot of big interests and we could not possibly be found carrying out any of his recommendations, even if we thought they were in the best public interest."

Now if what I have said to you has awakened any interest in your minds regarding the New St. Lawrence you can crystallize this interest into useful work by collectively and individually taking up the question of having the Congress of the United States make effective the recommendations of the International Joint Commission I have quoted.

I doubt very much whether any of the men in this audience realize the pitiful lack of leadership that exists in our democracy to-day. You would think that great governments like those of Canada and the United States, with full knowledge of all of the benefits that can immediately come to fifty million people by the building of the New St. Lawrence, would be actively and aggressively taking all of the initial steps and carrying out the work as rapidly as prudence and good judgment would permit. But alack and alas, this is not so.

If you gentlemen want to see ocean-going vessels on the Great Lakes; if you want lower freight rates on all of the commodities you are interested in; if you want a greatly increased business with Canada, and if you want to see in effective commission all the other blessings I have enumerated, then you should get after your representatives in Congress and demand this New St. Lawrence.

President Harding has enthusiastically declared himself in favor of the New St. Lawrence.

You can not expect, however, your delegates in Congress to act until they hear from the folks back home.

If you are interested in a New St. Lawrence get after Washington in the ways you know will be most effectual.

THE UTILITY OF CULTURE*

By Robert P. Butler, Esq., Corporation Counsel, Hartford, Conn.

The subject that I desire to speak on relates to the need of cultural education for the engineering profession. I do not know of any field which offers a more romantic opportunity for observation and study than the field of education in America over the past one hundred and twenty-five years. There is nothing in which there have been such remarkable changes, such remarkable expansion, and growth of practical or applied knowledge. One hundred and twenty-five years ago the field of education in America was confined to the old rational culture,—rationalistic, philosophic culture—an inheritance handed down to us from the ancient to the renaissance, and the best of the renaissance, period. Practically all the higher education in this country was cultural education, pure and simple.

The men who went to college after getting out of private schools, if they went far enough at private school beyond the three R's, were, in general, of three types. First, the prospective gentlemen of leisure, who went to college purely for cultural purposes. They were comparatively few in number. Second, teachers, who were, after college, going back into preparatory school or college to teach, or to devote their lives to scholarly and cultural research. Third, the ministers.

The time had not yet come when lawyers were going to college. Few of them did, on the money received by most lawyers in those days. After they got a little learning, they went into the office of some noted lawyer and acquired their legal education there. Most doctors were graduates, not of medical schools, but of other doctors' offices.

In the three professions of the ministry, the law, and medicine, but one represented really highly cultured men, and those were the ministers. Engineering as a profession, much less a higher profession, had not then been dreamed of.

We went along that way for quite a few years. Then the practical application of steam was discovered, and, not long after,

* An address before evening session, February 20, 1923.

electricity came along. The rapid printing process came into action. There opened up and unfolded, almost over night, an unbelievable, almost unencompassable field of practical knowledge in transportation, building and construction, in a great raw country which for millions of years had not been touched by culture. A country in its raw, natural state was opened up to the world. Immigration began to pour in. The pioneer pushed on and on, further and further;—building, constructing, developing. We were plunged pell-mell, helter-skelter, into a new and ever more and more rapid practical application of an ever growing science.

The purely cultural education of the centuries was shifted into the background. It had to give way, of necessity, to the practical and utilitarian. And, before we knew it, this great country became a wild, seething mass of materialism, touching almost always problems of the physical. Culture of a moral, ethical, sociological and psychological nature was lost sight of by the large body of men doing the work of the world. Teachers were relatively few in number. Education in the grammar grades had a trend toward the scientific and utilitarian,—the practical. It was the philosophy of the pragmatic which laid hold upon our lives. Instead of the subjective, the introspective and the cultural, we dealt with the objective and the practical. Science with her laboratories was not bound by traditions as was the old culture. There was no long period of centuries to look back upon. There was not that heritage. Science is properly skeptical, unbelieving, unfettered.

And so the old was unseated, and the conquering march of the scientific and practical caught up the world with their outriders, clear out unto the widening horizon. That was the situation up to within a few years.

It was not so long ago, when no man who wanted to go into the practice of law, unless he was well fixed financially and had plenty of time, ever thought of taking a general collegiate education,—a general cultural education. He went right into the practice of law. It is not so long ago that our doctors did not see the necessity of a general cultural preparation as a foundation for their work in medicine. To-day, however, the higher class law and medical schools require not less than two years of academic work in preparation for the freshman class in the professional school, and most

of them are getting to the point where an academic degree is demanded.

The profession of engineering has not yet reached that point, but it must arrive there, if it is to remain where this rapid push and urge of the practical has placed it. It must recognize first of all, as a broad fundamental foundation for engineering work, the utility of culture.

It will not do to raise up in scientific fields a body of men who for generation after generation are not in touch at some time or other, and preferably in the plastic and formative period of youth,—when the mind receives most easily and holds most surely—when, I say, those minds who are doing and are going to do scientific work of the world, are not at all in touch with the highest and best thought of the best minds of all times. It must come.

I do not say that a man will build a better bridge, or run a better tunnel, or construct a better highway because he knows something of the dialogues of Plato, or of the history of the romantic period in the renaissance. That is not true. But I do say that a man who is going to be a great engineer, a great builder, will have a better knowledge of the needs of humanity and of what his profession can do for humanity, if he has dreamed the dreams and seen the visions of the finest minds of all times. He will have a better outlook upon his relation to society as a whole, and he will be a better servant to society as a whole, and a better citizen. And because he is a better citizen, and so a better professional man, he may not earn more money, although I think he will. But this is the thing, the only proper point of view for any higher form of activity such as engineering, or the legal, medical, ministerial or teaching professions, and that is the question—"How much is the productive period of my life going to contribute to the sum total of the best of my own period?" Isn't that true?

I maintain that the man who has the best foundation, who is thinking the best thoughts of his time with the best minds of his time, whose sympathies are broadest, is the man who is going to contribute the most, directly and indirectly, and is the man who will best understand the problems of his time, and his relationship to those problems, and who will form an intelligent idea of what he can contribute, and how he can contribute it. Now, how is this thing to be brought about?

These institutions of learning, outside of state universities, are

independent institutions, owned, not by their directors, not by their professors, not by the students which at present inhabit them, but by the alumni. That means you. And the movement is already under way,—you men know of it, you are in touch with it. You are the men who must take hold of the scientific institutions of this country and demand that as a part and parcel of the education of the incoming generations of engineers, there shall be at least two years of general cultural preparation. A man should have a fair knowledge of history and philosophy. Practically all of the mathematical sciences came from philosophers, from Pythagoras down, and yet few if any scientific schools in this country require any study of history or philosophy as part and parcel of the preparation for practical engineering work.

I maintain that a man who has not studied the details of history or philosophy, from the early Greeks down, has absolutely no knowledge, unless he gets it independently of the school or college, of the history of the development of the human intellect and its relations to the practical problems of life. A man should have a first class working knowledge of the development of morality and ethics, and know something of sociology, and at least one thorough-going course in pure aesthetics.

I am not insensible to the sheer beauty and romance of what science has done in the last generation and a half, but the unfortunate part of it is that such beauty and romance is not ingrained in the scientific education of the men who are accomplishing these things. They are absorbing it from without and not living it from within.

And so I ask you men, in your relations with your own institutions from which you came, where your education was not obtained but started, to try to develop in those institutions, as a matter of public service, the immediate and direct appreciation of the utility of culture in your own line of work, so that the men who come after you will have a foundation in the practical, and also in aesthetic culture which will make them men of bigger vision, bigger possibilities, broader sympathies, and greater usefulness.

RADIO DEVELOPMENT*

Hiram Percy Maxim, President, American Radio Relay League.

Mr. President and gentlemen,—I cannot help thinking of some of the things Mr. Butler has said, because you know, standing up before a lot of hard headed engineers and talking radio makes a man feel as if he were,—well, getting rather esthetic.

I am a mechanical engineer, and why in the name of heaven I am called upon to address my fellow engineers on such a subject as radio, gets me. However, that seems to be the programme.

But, seriously, gentlemen, it is worth talking about. Not long ago, perhaps five or six years, if you had been told you would be listening to a talk on radio, you would have thought of other things you would rather do. Times have changed. In these days of the ultra-scientific, it is refreshing to leave for a moment such things as bridges and roads and those big engineering problems that have to do with tons per square inch, tensile strength, etc., and to relax by delving into the realm of the absolute basic principles of nature.

Of course we civil and mechanical engineers deal with basic principles; but we forget sometimes that there are important basic principles which we never have anything to do with. These are what I am going to talk about, to-night.

We like to say, "What a wonderful thing radio is!" It is not so wonderful as you think. Every time a man builds a fire and uses the light of that fire for signalling purposes, it is radio. It is light. If we build a fire on Long Island, and then drop some kind of a curtain between it and a man standing on the Connecticut shore, and we have a pre-arranged system of lifting and dropping that curtain, the man on Long Island is communicating across space to the man on the Connecticut shore, by radio. He is doing it by means of the same sort of an influence that is used in real radio.

It is interesting to think of what is going on in that signalling fire. The same thing on a glorified scale is going on in the sun. Something has left these hot embers and gases in the fire on Long Island and has crossed Long Island Sound in an incredibly short

* Presented at the meeting of Feb. 20, 1923.

length of time, where it has made an impression upon the retina of a human eye. Just so with the sun. Something leaves the sun and travels across ninety-three or ninety-four millions of miles, and leaves an impression upon the retina of an eye. This thing, whatever it is, travels at the rate of something like 186,000 miles a second. That is the velocity of light. That will go about seven times around the world in one second. I believe we used to say, if I remember correctly, that it takes eight minutes from the time it leaves the sun until it arrives here on earth. That is a wonderful thing, in itself. But stop! Think of the nearest fixed star! That same light or influence took weeks, coming at the rate of 186,000 miles a second, to reach our eye!

The thing that comes across that space,—that incomprehensible great interstellar space—arouses every thinking man. To think that it should even come from those remote spiral nebulae we have recently seen in powerful telescopes. Doesn't it make you thrill to think that the light which reached that plate at Cambridge, on that night two years ago, and made its impression on that film, left that spiral nebulae 800,000 years ago? And all of that time it was coming at the rate of 186,000 miles a second! This universe is a terribly big place, my friends.

It is this that commands men's minds, in radio. It is radio. That is what radio is. It is light. But the only trouble is that it is invisible light. Your eyes and my eyes are built to respond to four thousand billion of oscillations a second,—between four and seven thousand billion of oscillations a second. That is a good many oscillations in a second, but you know it is in these magnitudes that we have to think, when we get into things like radio.

Radio and astronomy are very close together. These eyes of ours, these curious organs we have in our heads, which respond to light,—respond only to the frequencies mentioned. If those oscillations are coming in at around four thousand billions in a second, they appear to your eye and my eye as being a very dark red,—just above what we call infra red. If they go on up and finally reach the frequency of seven thousand billions of oscillations a second, they appear to our eye as being violet; and if they come a little bit faster, we get into the ultra violet, and your eye and my eye are unable to respond and we are unconscious of any light shining.

We have known all this for years. Then there came a day, when a man said, "It would be a great scheme, wouldn't it, if we could communicate across space, beyond the limits of our eyes and voices, without a conducting medium,—a wire. That would be a great thing." And, gentlemen, it is very impressive if you will look back and see the number of engineers, like ourselves, who have worked and burned the midnight oil, to make the determinations that were necessary to do this thing. It waited for Marconi to gather them all together and develop them and actually communicate intelligence across space by means of invisible light. It is worth while to review what some of those fellows did.

There was an Englishman named Maxwell. He announced that the discharge of an electrical condenser, a Leyden jar, which is a glass bottle, with tin foil on the outside and tin foil on the inside is oscillatory in character. Maxwell said this ought to be the same thing as light. Both are oscillations in, what we shall have to call, the ether. These oscillations will travel at the rate of 186,000 miles per second, which is the velocity of light.

Then there came a day when a man named VonHelmholtz, of Berlin, Germany, had a student named Rudolph Hertz, and he said to this young man, "Why don't you study into this relationship that probably exists between the discharge of electricity from a condenser, and dynamic electricity. A reward has been offered by the Berlin University of so many marks for a good layout of this subject." Hertz answered, "I will try." And then Hertz worked and worked and worked, and came back and said, "I give it up. I can't do it. I can't find the connecting link. I am stuck." And he gave it up.

Then, one day, after he, himself, had become a teacher, he arranged a discharge between some apparatus,—just a loop of wire with a gap in the top,—and let this spark play, which was the discharge of an electrical condenser. It was spreading out ether vibrations at a certain number of oscillations a second way down below what is visible to Hertz's eyes, and he little dreamed of what was going on. He happened to set up another little loop of wire nearby. Now, what happened? If it had not happened,—if one single thing had been different than it was,—I would not be here to-night talking radio to you. It was this. When Hertz started his little spark here on his left, he noticed that a little spark also appeared in the little nearby loop. He said, "Why, that's a funny

thing. Let's try that again." He tried it again, and the little spark returned in the nearby loop. There was no electrical connection between the two. Hertz saw that something had traversed space. Something had passed across from his spark to his loop. And he said, "I wonder if it could possibly be that these two systems happen to be in tune with each other. I wonder, if I should change the capacity or the inductance, that is the length or size of the wire, if this thing would traverse space and be apparent over here in that loop?" He changed things, and it did not happen, and he changed it back, and it did happen. Hertz had discovered resonance.

Resonance is that thing, when you raise the piano cover and by means of your voice or any musical instrument strike a certain note, that same note will be generated in the piano. If you strike middle C, middle C on the piano will respond. That is resonance. Electrical resonance is what Hertz discovered. From then on, radio was a sure thing.

The next thing Hertz did was to determine if this curious transfer of energy was subject to the laws he suspected it was. He made some experiments and found it was. Then he saw that everything could be predicted, if you knew the laws governing light and the refraction and reflection of light. So he announced to the world, "This thing is the same as light, and we can communicate across space, if we have two electrical units in this condition which we call 'resonance.' "

All right. But he couldn't get to communicate any considerable distance. Then a man named Edison came along. He had nothing to do with Hertz at all. Edison started to build incandescent lamps. He discovered that if there were a metal plate inside of the familiar bulb, in addition to the filament, that a current of electricity would flow across from the hot filament to the plate. But he didn't know what to do with it and no one else knew. He put it away with the announcement that anything that is hot is bombarding surrounding space with small electrical corpuscles. We call these corpuscles, electrons. And he put the thing on the shelf in the year 1874, or thereabouts.

In the meantime a man in the northern part of Italy was coming along. It was Marconi. He read what Hertz had done. It interested him. He said, "If Hertz established some sort of an electrical oscillation on this side, and got something over on this

side, when in resonance, then he transmitted across space. If he can transmit three feet, why can't I transmit 30 feet or 300 feet or 3,000 feet?"

With all the passion of the Italian, and with all the scientific attainments that this man had, he went at his problem and put into it what we engineers call real engineering zeal. That is the kind of a man he is. I know him and I know whereof I speak.

But the question was, how could he get this feeble little bit of current, picked up in this receiving apparatus, to be noticeable to any one of our five senses? He ransacked scientific knowledge. There was only one thing he could find. A man named Brownley had discovered that if you put inside of a glass tube, some iron filings, and have terminals sticking at each end and pass a very feeble magnetic strain across the tube, it somehow upends those little iron filings and gets them into better contact with each other. A very sensitive detector of magnetic strain lines was what it was. It was called a Brownley coherer.

Marconi took Hertz' discovery and Brownley's coherer, and went to work to build something. He had no standards nor previous experience to go by. "What kind of a thing is it that I must build, that will spread this influence, these oscillations?" he asked himself. He tried everything he could think of, and the thing that worked best was a wire, up in the air. It took a long time to find that out. But it seemed to be the best thing. Then he said, "I wonder what would be the best thing to collect it with?" He tried everything. And he found that the best thing to collect it was the same kind of a thing that sent it, and that was a wire, up in the air. The higher the wire the better. And so he connected a wire up in the air at his transmitting set, and a wire up in the air at his receiving station, a mile apart. In his receiving wire he put the coherer, and after months of the hardest kind of work, one night the coherer responded. He had achieved wireless communication.

But one mile was not far enough. You could signal with a flag or lantern, that far. It had to be further. He put in more power, but it did not always work. Then, by accident, he found there was another combination of something he had done, he did not know what it was, that made it a hundred times more sensitive. It was better resonance. When all his energy was in one wave instead of being scattered over a lot of waves, he magnified things

tremendously at the receiving end. He had more energy and a louder signal.

All right. There was a man named Fleming, an Englishman. He said, "It is a pity that Marconi is limited to that coherer, because that thing is not sensitive in the modern idea of the word. Isn't it possible we can find something that is more sensitive?" And so he took his turn and ransacked scientific knowledge. Away back on the dusty shelf where it had been laid in 1874, he found Edison's incandescent lamp with that little metal element inside of it, and he said, "By jove! I wonder if that will help?" He pulled it down off the shelf and rigged it up, and found it was a rectifier of the feeble alternating current that these oscillations set up. Such a rectifier would give him continuous current or uni-directional current, and this would cause a response in a telephone receiver. He made some elaborate determinations as to telephone receivers and found that a receiver could be wound which would cause an audible sound with a current of something like 100,000ths of an ampere flowing through those windings. That is very small.

So Fleming said, "Let us put the Edison's device into use and call it a Fleming Tube and we will be able to receive signals with our ears instead of on a printed tape and Marconi will be assisted and I will have honor and glory. And he did, and it worked. It was a hundred times more sensitive than the most sensitive coherer that Brownley could make.

All right. But Mr. Fleming made a mistake. We all make them. I have made lots of them. He sat back and said, "There you are. You see what I can do." He thought he had finished the job. He had not any more than just begun it. Instead of getting busy and finding out what else could be done another man came along and did it for him. This man's name was DeForest. He said, "If that thing is as sensitive as that with only one-half of the current, what is the matter with going on and finding how far we can go? Let us put another element inside of the incandescent tube, and call it a grid—a corrugated wire—because I have found that if we impress on that grid ever so little voltage, it will have an enormous effect upon the current flowing from the hot filament to the plate."

So DeForest took Fleming's tube and made an Audion Tube, and it was a thousand times more sensitive.

Well, when that day came, I said I must have one of these tubes. But they are awful hard to get. I got one, however, and I found that, instead of just being able to get on a good night, with your ears in fine condition and everything about your station in apple pie order, that fellow in Springfield,—I found the minute I turned on that little bulb, that Fort Wayne, Indiana, came in. Gentlemen, I cannot tell you the thrill that went up and down my backbone that night. I remember the signals were from a fellow in Fort Wayne, Ind. I sat down and wrote him a letter, and said, "Please, for the love of Mike, tell me, did you, at this hour, say this?" And he wrote back and said, "That is just exactly what I said."

Well, then DeForest made the same mistake that Fleming made. DeForest sat back and said, "There you go. Fleming didn't get there. I'm the fellow that fixed it. Look at me." But a fellow named Armstrong came along, and said, "Let's see; DeForest hasn't explained how this thing works. I don't believe he knows how it works. If he did, he would say so, and he has not said. Let's find out." So Armstrong set about the task of finding out what actually happened in that little glass bulb that had a red hot filament and a plate and a little corrugated piece of wire in it. One day he said, "Isn't that a funny thing! The performance of these instruments indicates that this thing is doing exactly the same as a telephone does when it howls." Most of you know that if you take a telephone receiver off the hook and hold it up against the transmitter, it will howl, and central does not like it at all. What happens? When you made that first contact of the receiver against the transmitter, you made a noise, and that noise was transmitted telephonically and came right back into the receiver and made another noise, and that noise went out and came back and made another—a regular feed-back system. As long as you hold it there it will howl.

So Armstrong said, "That is a funny thing. Do you suppose this thing is howling at an inaudible frequency? If it is, it is generating these oscillations, because any current of electricity that flows at a frequency of around a million, is sending out invisible light or radio waves." So Armstrong made careful tests, and incidentally made a sketch and had it witnessed and took it to a notary, and later on that sketch brought him 500,000 good dollars, so it is claimed.

What Armstrong did was to discover that this vacuum tube—the greatest invention in our day—would oscillate and send out electrical currents of frequencies of the order of light. That is, invisible light. And this is where we are to-day. You go home, put on the vacuum tube and heat the filament red hot and make the proper adjustments, tune up, and what happens? It is an interesting thing to think of. The minute the grid gets a little current on it, a little voltage, it sucks more current out of the red hot filament, and the current goes up, and up and up until it gets to a certain critical point, when it stops increasing. When it stops the inductive effect stops. When the inductive effect stops there is nothing to hold the plate current up, and it falls. This falling reverses the polarity on the grid and blocks the current and hastens its fall. At the bottom it stops, reverses and goes up again. It is thus an automatic device which makes the current rise and fall or oscillate at several million oscillations a second.

That brings us to the present time. We have a means of transmitting out into space an invisible light. We amateurs have been in the field from ten to fifteen years. The United States Government said to us that we could transmit at a frequency of 1,500,000 a second and no more, and could use only about a kilowatt of power. In 1912 a law was passed, with the idea back of it that "we will give these amateurs such a high frequency—a million and a half per second, and so small an amount of power that they will never get beyond the confines of the block in which they live and so will never cause interference with the naval stations or shipping."

That was in 1912. Gentlemen, in ten years' time, we amateurs took our little 200 meters and our thousand watts and we perfected apparatus to such a degree of efficiency that it was no longer possible to hold us in the block or in the city or in our state or in our hemisphere. We are able now with our feeble little amateur currents and high frequency to transmit to England and the Hawaiian Islands.

The other morning I had another little thrill. I had sent a message to a fellow in Cleveland—8 B W Y was his call. I called him from my place in Hartford. He came right back and said, "Good evening." I said I had a message, and he said "GA" which means, "go ahead." I gave him a message to my sister-in-law who lives in Cleveland. That was about six days ago. In this

morning's mail I received a letter from Porto Rico from a man who was not able to handle the English language very well, and he said he had heard my message to Cleveland, and in his letter he repeated the message, asking if that was correct. It was correct. Sitting in my library in Hartford, sending my message to Cleveland, little did I think that that man in a little shack down in Porto Rico was copying it.

Mr. Marconi, a little over a year ago, electrified us with this: He said, "Gentlemen, I have been off in my yacht. I have been to the Antipodes. I have been here and there, and the other places which have curious radio characteristics, and I have studied atmospherics, or what we call statics. I have studied the curious things that follow a thunder storm. But, gentlemen, I have found something which is neither. I hesitate to say what it is, but we have recorded signals time and time again, at wave lengths beyond anything used on this earth which occurred in an order of sequence, which indicates that they must come from intelligent beings. I wonder if they come from somewhere off this planet?"

That is quite a thrilling thought, isn't it! It starts us thinking. It leads us away back into the remote past. There was an ancestral sun, long before our earth came into being, and that ancestral sun was a great big blob of incandescent material. I haven't said it was liquid or gaseous. It was one or the other. And then a time came when a wanderer strayed in, from interstellar space, and as this wanderer approached this big ball, the attraction of gravity caused bulging and explosions and eruptions of an incomprehensible magnitude. Great masses of white hot material, hotter than white hot, were thrown out. Now, isn't it a funny thing that all of the planets, Neptune, Uranus, Jupiter, Saturn, Venus, Earth, Mars, Mercury,—isn't it a funny thing that they all follow around the sun on pretty nearly the same disc! Their orbits are only seven degrees apart. Isn't it a funny thing that we are all in line, so to speak? This great wanderer, as he approached, caused these titanic eruptions to take place. I have seen photographs taken at Flagstaff which are absolute replicas of what must have happened on that distant day on a stupendous scale. And these same things are going on now. We can show you pictures of solar systems in the building, for the spiral nebulae shows exactly what must have happened to our sun. The bulgings, due to the tremendous amount of energy involved, were

projected out into space. Some of them fell backward but the Sun had passed, and they took an orbit around the sun, and gained accretions of dust and other things, and finally became planets. Our earth is one of these.

This is happening to-day, as I have said. We can look in the sky and see it. It has happened many millions of times and this brings me to the point I have been leading up to. Is it reasonable to say that this one little globe of ours is the only one of these myriads that contains a life germ or boasts an intelligence? Isn't it reasonable to think that some of those other bodies up there also possess intelligence and life germs? If so, and if they, any of them, are older than we, then it may be another reasonable assumption to say that their intelligence exceeds ours? And some day, gentlemen, isn't the time coming, when we will have that great thrill, the greatest thrill that ever has come to mortal man! When, out beyond interstellar space will come a communication from some intelligent being!

We have many thrills, in wireless. We have reached the point where we have the whole world connected by radio. You can put up a wire in your house, or in the air outside of your house, and the air is full of communications. We can string a wire from end to end of this hall, right now, and put in a vacuum tube, with its accompanying devices, and get a mess of music, speeches, trans-oceanic and trans-continental telegraph signals. It would be bedlam if you could not separate it. You men, when you go home to-morrow can for a few dollars buy the necessary things to get into this—this new, wonderful thing with your own hands and brains. I want to tell you, if you have not taken a try at it, it will pay to try, because when you handle it you get that idea I have been trying to convey,—that you are dealing with the most wonderful thing mortal man has ever dealt with.

I thank you.

THE ROAD SITUATION IN CONNECTICUT*

By Charles J. Bennett, Member Connecticut Society of Civil Engineers, State Highway Commissioner.

It is with a feeling of infinite smallness that I approach the subject I have in mind, after listening to Mr. Maxim. His remarks made a tremendous impression upon me, and I trust they did upon you. Those of us who work with material things are amazed when we listen to dreams like Maxim's—dreams which he has fulfilled, and other dreams which others which come after him will doubtless fulfill to a great extent. I apologize for speaking of practical things, after such a wonderful address. I have heard Mr. Maxim speak before, but never so well as to-night. I want to thank him personally.

Connecticut's highway problem is a simple thing when you think of it in terms of radio, but is not so simple when you think of it in terms of Bennett. I was asked to present to you in fifteen minutes, a statement of the problem which I have been trying to surmount for ten years, and to put in a small space of time things which would fill a large book.

Connecticut's highway problem at the present time must be viewed first in terms of meeting it. That is, in terms of the money which must be spent to solve this problem. Any study of the problem must begin at the point from which we secure the necessary funds for carrying on the work.

Sources of revenue from which improvements are paid for, are four. First, the state appropriates money from the income of the state secured from many different sources, but eventually from the tax payer. Second, the motor vehicle fees which you gentlemen pay—those of you who are horny-handed enough to earn money enough to purchase an automobile, many of whom object strenuously to the amount of money they have to pay for that purpose. Third, from the towns who contribute a portion of the cost of building these roads over which we travel. The fourth source is from Federal funds. Those four sources of revenue are the ones from which these state improvements are made.

* Presented at the meeting of February 20, 1923.

Where is this money spent? On road and bridge construction, trunk line and state aid. Also on road maintenance and reconstruction. The construction of roads is paid for out of state appropriations, and out of the share contributed by towns, and to some extent out of Federal aid money. Maintenance and reconstruction are paid for out of motor vehicle fees and out of a portion of the Federal aid money. The division of Federal aid money between construction of new roads and maintenance, is an arbitrary one, based upon the evident need for reconstruction of roads to accommodate the traffic to which we are subjected at present, and the extension of roads out of any appropriation must inevitably become much less as the traffic over the roads increases in amount and in weight and in its other dimensions.

I think Connecticut's problem at the present time is more nearly one of replacement than of new construction. It seems to me the state at this moment is fairly well served with roads reaching into the most active parts of the state, serving the greater proportion of its population. But it is not so well served in the character of the roads which have already been built. Therefore our problem is one of replacing roads already built, with structures which will be more nearly adequate to the traffic to which these roads are subjected. For that reason our attention must be paid more definitely in the future to the replacement of worn-out roads and the extension of roads; construction of new roads becomes of secondary importance.

In view of the facts I have mentioned, and in view of the financial situation, it seems evident to me, from the knowledge I have secured from the work done, that there is a limit to the amount of money which this state can spend for road improvements of any sort, and I think that limit can be plainly expressed in terms of the amount of money spent per year. In order to be clear on that topic, let me say that I think the State of Connecticut cannot with wisdom spend more than seven or eight million dollars per year for road work from all four sources of revenue I mentioned.

There are several reasons why we cannot spend more money than that, wisely. Two of those reasons are outstanding. The first is that highway work is only one branch of the activities of the state, but we are at present spending a little more than one-third of the total expenditures of the state in any one year, on

highway work, and it is not fair to the rest of the state's activities to concentrate any more work in the Highway Department than the state can bear economically. The second reason is more important from an engineering standpoint, and that is, we cannot efficiently spend more money than that, because we haven't at hand a sufficient amount of labor or a sufficient number of well equipped contractors, or, if you please, a sufficient number of competent engineers, to do any more than that amount of work. Consequently, it seems to me, our work must be confined within that limit of expenditure.

There are many advocates in this state, as in other states, of large expenditures for road work; but on account of the labor situation, and lack of financial ability, and lack of knowledge of the ultimate traffic, it seems to me that the extension of the work beyond the funds received from immediate tax levies or the immediate supply of money, is unwise. I am not an advocate of bond issues or extended credits for the construction of roads in Connecticut or in any other state.

There has been a great deal of interest in this work, in trying to outline for the Legislature and for the department a scheme of road development which will fit the revenues to be secured, and to try to satisfy to some extent the demands or wants or wild desires of those who would have roads everywhere. One of the most important and interesting things that we have to do is to try on the one hand to keep the expenditures down within the limits I have mentioned, and on the other hand to satisfy those legislators who demand a considerable amount of improvements beyond what might be considered reasonable at this time. Let me interject here. There are 170 bills before the Legislature which, if carried out in their fulness, would cause an expenditure of seven and one-half million dollars for road extension alone, without any regard to immediate needs of reconstruction or maintenance. This shows, to some extent as a side light, what the Commissioner has to contend with.

There has been a good deal of discussion in connection with the highway problems of various states, of Federal aid. A policy was established by Congress, some five or six years ago, the purpose of which was to help the states in the construction of their roads, under Federal aid. Up to the present time the United States Government has appropriated 400 million dollars to be

expended, according to the wording of the act, in improvement of rural post roads; but that sum of money must be met by appropriations by the states of at least an equal amount, meaning that a total of $800,000,000 has been made available by Federal action for the construction of highways everywhere. Of that $400,000,000, Connecticut has received $2,500,000, which you can reduce to percentages for yourself. In other words, Connecticut's share is very small.

There are certain people here and in other states who feel that because the amount of this Federal aid received by the smaller states is so small, while the tax levies for governmental purposes on those states are so high, that there is injustice in Federal aid, because we pay in more than we get out. It seems to me that any attitude of that kind is rather unwise, because this Federal aid, if properly administered, will tend to develop the United States as a whole, if there is any virtue in highway improvement. It is the duty of those parts of the government which are strong financially to aid in the development of those parts which are not so strong, in order that the whole United States may be better on account of the efforts of the component parts of it.

Further than that, Connecticut, or any other state, is not confined in its business activities to its own borders, and here in Connecticut we are particularly interested, it seems to me, on the ground of industry and insurance, and our other activities, in the development of the country. There isn't an activity in the United States which is carried on at the present time but what the Yankee gets his hand into it, sooner or later, and the development of industry everywhere is of vital importance to Connecticut.

Therefore, Federal aid, if properly administered—and that is a pretty big if—is going to be a great benefit to this state.

The first idea that came up when Federal aid was established, was that it was going to be something under which work could be done to benefit the individual. That is, every Congressman who came from any state was anxious to have a piece of road in front of his own house. The result of that policy, which is a ridiculous statement, would have been a disconnected highway system. Realizing that that sort of thing would not go, in the long run, the Bureau of Public Roads, the state highway officials who were strongest, due to their position at home, were able to

form an association which has guided the activities of Federal aid; so that at present the law has been amended so that Federal aid money shall be spent on connected highway systems, which comprise about seven per cent. of the entire mileage of the United States. The eventual result of that policy, if carried to a conclusion, will be that the United States will have a system of highways second to none in the world. It is fair to say that at present we are not in that position. This association has been able to do a great deal toward the accomplishment of that purpose, and we have also been able to do something towards the development of state highway departments in those states which had none.

So that Federal aid, although at first glance inadvisable for the smaller states, will, it seems to me, eventually work out to the benefit of the nation.

I suppose that any statement regarding Connecticut's highway problem would not be complete without a statement as to what I think may be the future of the highway department of this state, after I leave it. I hesitate to say anything much about it, because I don't know much about what it will be. Let me say this, however, in conclusion, and with all sincerity. I have the utmost faith in the State of Connecticut, and that the affairs of the State Highway Department will be fully as well administered after the present official leaves the job as they are now, and I hope that every man who has anything to do with the situation will put the same belief in Connecticut that I have. I believe in the country, and in this state, and in the men who administer the affairs of the state, whether they be Republicans or Democrats, and I haven't much patience with the man who throws rocks at the government because it does not do the things he wants to have it do. Connecticut has always been a well balanced state and a land of steady habits, and whatever of success has been achieved by the Highway Department up to the present time has not been so much because of the man who held the job, as that that man had to measure up to the job in which he was placed.

THE GARBAGE DISPOSAL PROBLEM IN AMERICAN CITIES.*

By Theodore R. Kendall, Engineering Editor, The American City Magazine.

The Neolithic Age began in Europe about 10,000 to 12,000 years ago. The sources of information about the life of the European Neolithic people are their refuse piles. Along the Danish coast the refuse accumulated in great heaps, known as kitchen-middens. These kitchen-midden folk had no refuse disposal problems, because as soon as the piles of refuse became annoying in any way, they moved their community to another more favored spot. Since that time through the development of villages, towns and large cities, the garbage and refuse disposal problem has increased many fold, until to-day it is probably the foremost problem to be solved in most cities. American cities, perhaps, find more difficulty in disposing of garbage because of the larger per capita production in this country than elsewhere.

Refuse collection and disposal in American municipalities has been replete with mistakes. In looking over the field, one is impressed with the great variety of disposal methods in use and the abruptness with which cities change from one method to another, sometimes abandoning apparently useful and expensive plants which seem to be operating successfully. Los Angeles, after seven years' operation of a garbage reduction plant, abandoned it, at least for the present, in favor of hog feeding. Baltimore, after a few years of hog feeding as a means of disposing of its garbage, turned again to reduction, and Buffalo, with hog feeding established for a while, has recently taken bids for incineration. The large reduction plant at New York was abandoned for dumping at sea and a group of incinerators in Seattle was abandoned in favor of sanitary fill. These are only a few examples of the many ups and downs of a satisfactory solution of garbage disposal in some of our more important cities.

"What every city needs to know and act upon to-day is that fundamentally garbage disposal is a matter of civic cleansing, rather than of public health

* Presented at the meeting of February 20, 1923.

and that the main object in choosing a method of disposal and operating a disposal plant is to get rid of the garbage at the lowest possible cost consistent with the production of a reasonable minimum of offense to sight and smell. In addition, every city needs to know that the country is dotted with abandoned disposal plants of all types, partly due to unwise original choice of methods to suit the local conditions, partly to poor design by inexperienced engineers and promoters, but most of all to failure of the administrative authorities of our cities to recognize that garbage and refuse disposal is an engineering problem, as regards both the design and operation of the plant.

"Unfortunately, most of the engineers of the country, even those in the municipal service, know little about garbage disposal. For a hundred engineers who have specialized in water and sewage treatment, we have one or two who have mastered garbage disposal. Consequently, in the all-too-rare cases where the City Council or Board calls on some member of the city engineering staff for advice, the chief gain is not in having the advice of an experienced specialist, but in getting an engineering view of the problem. That is an unquestioned gain in all cases and a great gain in some, but it does not take the place of advice from a specialist and but a few of our cities have an engineering staff from which a competent man may be detached and given time to inform himself as to garbage disposal.

"Until conditions in garbage disposal as a part of the general city administration and also as a branch of municipal engineering are improved, it would be a wise course for every city to go slowly in choosing or changing its method of garbage disposal. This is particularly true just now in view of the present high cost of construction and operation of garbage disposal plants and of the low revenue from such methods of disposal as produce a return that helps reduce cost."*

Collection.

The problems of collection of garbage, ashes and rubbish are closely knit together and are also intimately associated with the method of disposal. At once a diversity of questions arise. Shall the city collect garbage itself? Shall the city contract for its collection, or shall it depend on licensed scavengers? Shall collection be made by horse-drawn wagons, motor trucks or trailers and tractors? Shall the garbage be collected separately or mixed with rubbish and ashes and, if collected separately, shall the householder be required to wrap it?

The sanitary collection and disposal of garbage are the prime requisites to be considered, followed closely by the economy of the method. Disposal is, therefore, of somewhat less importance than collection.

* Engineering News-Record, December 7, 1922, page 961.

First and foremost, garbage collection and disposal should be put under the sole administrative control of one department under the immediate charge of an engineer experienced in this class of work. Whether collection should be made by the city direct instead of by contract is largely a matter of local expediency. The consensus of competent opinion, based on both theory and experience, favors municipal rather than contract collection. In a survey which I conducted recently, covering some 600 cities in the United States, I found that in the 63 cities of the 68 over 100,000 population from which I received reports, 13 had contract collection, 37 cities collected through municipal departments and 13 in miscellaneous ways, including municipal contract and collection by licensed scavengers.

It is interesting to note that in three states, Missouri, Michigan and Utah, the state supreme courts have ruled that where the city has entered into a contract for the collection of garbage, the contractor is entitled to all garbage produced, notwithstanding the contention of some citizens that the garbage was their own private property. Some cities have felt that garbage and refuse collection is the function of the Health Department. This is unsound. It should be conducted by the Public Works Department and not the Health Department, both because of the small relation of garbage collection to health, and because functionally the operation of public services is the affair of the engineering department of a city.

The great majority of cities have separate collection of garbage. Cities with incinerating plants usually have combined collection of garbage, rubbish and ashes, while more often the ashes are collected separately from the other two and used for fill. The particular problems of individual cities regulate the proper combination to be used. Separate collection of garbage, rubbish and ashes is generally required where the garbage is reduced or fed to hogs and sometimes where it is incinerated. The combined collection of garbage, rubbish and ashes is characteristic of cities using complete incineration or dumping. Separate collection of garbage and combined collection of ashes and rubbish is generally applicable to cities where garbage is utilized by reduction or feeding and the rubbish and ashes are dumped. It can also be used where there is complete incineration. The separate collection of ashes and combined collection of garbage and rubbish is usually in

force in communities where garbage and rubbish are incinerated and ashes used for fill. Aside from the method of disposal, which is the strongest determining factor, such items as the size of the city, the amount of waste produced, length of haul, dumping facilities and the like must also be considered. Combined collection is cheapest, as only one type of wagon is used and the same territory requires but one trip.

In most cities in the North, there is a much greater production of garbage in summer, the amount reaching a maximum in September when about one-eighth of the yearly total is produced and a minimum in February when about one-sixteenth of the annual total is produced. The production of garbage is practically uniform from month to month throughout the South.

The best method for determining the type of collection equipment to be used and the location of disposal or loading sites, is described in some detail in a report submitted a few years ago to the city of Cleveland by I. S. Osborn. Such unit costs as the cost of loading the various collection vehicles, the cost of hauling per ton-mile with different collection equipment, and the cost of transportation per ton-mile for long distances are first determined. Then, on a large street map of the city, small unit districts are laid out, corresponding to voting precincts, census districts or any other units of known population. From a knowledge of the production of garbage in homes, in wholesale produce districts and by hotels, the actual production of garbage, ashes and rubbish in each unit area may be tabulated on the map and from this, the haul in ton-miles within the area computed for complete collection. From these data the total haul in ton-miles to various disposal sites from different combinations of unit areas may be determined. Thus, the cost of collection, which is the cost of loading plus the cost of haul, may be determined readily for the whole city. The careful analysis of collection in this manner for various combinations of disposal sites will readily show the most economical combination of sites and collection equipment which will minimize collection costs. The disposal sites which I have just mentioned may be a number of incinerators scattered about the city, one reduction plant or a number of loading stations from which the garbage is transported by large motor trucks or railway cars to the actual disposal site outside of the city.

It is doubtful if any alderman ever succeeded in being re-elected following the location of a disposal site in his ward, for no matter how hard he may fight against it, supporting the various contentions of his constituents, he is always blamed for the choice of that particular site. It is unfortunate that the American public is not sufficiently educated in the question of waste disposal to appreciate that the few modern incineration and reduction processes which can be recommended are not malodorous. If there is any odor from a high temperature incinerating plant or a modern reduction plant, it is more likely due to the concentration of garbage-filled wagons at one point waiting to be emptied than to the actual disposal process itself. This objection was admirably overcome at the Toronto incinerator by housing the incinerators in a building much wider than was actually necessary. In this way, no matter how many collection wagons arrive at the plant at one time, they are all able to drive into the building and wait there to empty their loads into the charging bins rather than line up along the streets. This is a matter to be remembered by those who are facing the choice of incinerator sites and the inevitable objections which will arise.

Disposal.

The method of disposal varies with the population. A small community may choose almost any primitive method of disposal of its garbage. In cities of 100,000 and over, however, three methods have become practically standard and a fourth regretably still used by a few cities. Reports from 65 of the 68 cities over 100,000 population show that 5, including our largest city, still dump their garbage at sea or into large bodies of water, 24 dispose of it by feeding to hogs, 18 incinerate, and another 18 dispose of it by various reduction processes. Reports from about one-half of the 216 cities between 25,000 and 100,000 population show that 24 dump their garbage, 34 feed it to hogs, 31 incinerate and 2 dispose of it by reduction. Reports from one-fifth of the cities between 5,000 and 25,000 show that disposal by dumping and by feeding to hogs are about 2 to 1 with those who incinerate while one city disposes of its garbage by reduction. Cities and towns between 1,000 and 5,000 dispose of their garbage chiefly by dumping and by feeding to hogs, a very few burning it in small incinerators.

Let us discuss briefly the various methods of disposal and their outstanding features.

Specific Methods.

Dumping on Land is the original method of disposal of refuse in use 12 to 15 thousand years ago. Its use should be obsolete, as the method is crude and unsanitary. Unfortunately, it is the easiest way to get refuse out of the way, but fermentation and putrefaction produce an offensive odor and cause a distinct nuisance. If used at all, the system should be restricted to sparsely settled areas where waste land is available at a considable distance from all residences.

Dumping into Large Bodies of Water is inconvenient and unsanitary as those portions of the garbage which do not sink are usually washed ashore. New York City is the largest offender in the use of this method, followed by several cities on the Mississippi River which dump over their levees.

Burial is another method particularly applicable to small places, but liable to prove offensive and costly. Garbage is usually buried in small trenches or is plowed into the ground. It requires a large amount of land, situated far from the residential area, thus increasing the cost of haul. The garbage cannot well be buried more than 18 inches below the surface of the ground and must be covered with at least 10 inches of soil to prevent the production of odors. An interesting case of improper disposal by burial occurred in New Bedford many years ago when the disposal plant then in use broke down and for a considerable period the garbage was buried in a swampy area next to the plant. Some 15 or 20 years later, when excavating foundations for a new and larger plant, the authorities received a surprise almost equal to that of the tourists in Egypt on seeing Tut-Ankh-Amen's funeral garlands still green after burial for 30 centuries. The ancient New Bedford garbage was still green as it had remained moist and air had been excluded. In spite of this, burial is not to be recommended.

Sanitary Fill is to be distinguished from dumping or burial in that it is more cleanly, less costly and is productive of eventual return through the creation of marketable land. As practised in Seattle, it is used to fill in ravines, holes in the earth, tidelands,

swamps or low places. The secret of its success lies in the proper sloping of the area every day as soon as the material is dumped and covered with from 3 to 6 inches of fresh earth or sand. Ashes will do equally well if they are clear of combustible material. In Seattle, particular care is taken to avoid putting sawdust or any quantity of oil-soaked rags into these dumps as these materials produce spontaneous combustion and set fire to other materials. As soon as the dump is covered, heat is generated by fermentation, which, in the course of a few months, completely oxidizes the entire contents of the fill. The production of heat prevents nesting of rats or other rodents in the fill, thus eliminating this pest common in ordinary garbage dumps.

Feeding Garbage to Hogs is a method of disposal thought by some to have first been carried out on a large scale when it was recommended by the United States Department of Agriculture in 1916 and 1917, but the second largest city in Massachusetts has been disposing of its garbage in a very satisfactory manner by this method for over 45 years. Worcester has a population of 185,000. It has two collections per week, and the piggery is located 3½ miles from the city and 6½ miles from the center of production. The cost of collection is very high because of the long haul, averaging $7.25 per ton. The 50-acre pig farm, which cost $40,000 equipped, holds a minimum herd of 2,000 pigs. The city made a profit of $57,000 in 27 months of operation during the War, but prior to 1916 had only made a profit in 1902 and 1910. In other years the net cost ranged between $5,000 and $22,000. In 1916 considerable loss was experienced through the ravages of the foot and mouth disease so that the farm had to be restocked.

A number of cities in the middle west and west, including Denver, Colorado, make contracts with hog growers' associations. In Denver, for instance, garbage is collected at no cost to the city and is disposed of by the Hog Growers' Association by feeding to pigs.

The various combinations of municipal collection and use, of municipal collection and sale to the contractor, of contract collection and disposal, and the scavenger system, are all used with this method of disposal. Each have their advantages and numerous disadvantages. The best combination is municipal collection and sale to one contractor for disposal by feeding; thus sanitary collection is assured and the contractor is more likely to succeed

in the piggery business. A veterinary surgeon must be in practically constant attendance on a hog farm. All of the hogs should be inoculated against hog cholera. In Worcester the small hogs are inoculated with serum alone when about five or six weeks old. This renders them immune for about seven weeks. At the end of this time they weigh 40 to 50 pounds and are given a double treatment of virus and serum. The cost of the treatment, exclusive of help, is about 70 cents per pig. Less than one pig in 500 is lost and there is no trouble from ulcer formation if the work has been carefully done. About 250 40- to 50-pound pigs can be treated in a day by one veterinary with five helpers.

Newark, N. J., Buffalo, N. Y., and Baltimore, Md., have taken the gamble out of garbage disposal contracts where the garbage is fed to hogs by contractors. These cities entered into such contracts as shared with the contractor the high prices for live hogs that prevailed on the Chicago market for some time, running as high as 23 cents per pound in July, 1919. Since that time the price of hogs has fallen to pre-war levels and the price that the contractors must pay for the garbage of these cities has fallen proportionately. The prices paid per ton of garbage vary from 3½ to 8 times the price of hogs per pound on the Chicago market. The governing principle of these contracts might well be extended to other cities and to other services than garbage disposal.

Fuel Briquettes have been suggested by a number of companies as a means of disposing of garbage. One or more Texas cities have had disappointing experiences along these lines, which should act as warnings to other cities.

Incineration is one of the foremost methods of disposing of garbage in American cities, but cities contemplating incineration should not rely on securing revenue from the steam produced, although Westmount, Quebec, Milwaukee, Wisc., and Savannah, Ga., have been fortunate in this respect for many years. In the United States and Canada most of the garbage furnaces are of the low or medium temperature type which produce no steam, while, of the 30 high temperature destructors in the two countries, the three mentioned are the only ones that produce steam which is used commercially. In the selection of an incineration process, no reliance should be made on income from steam produced. In fact, it would probably be better if a city made no plans for the installation of boilers, but rather installed them after the plant

had proven a success in the incineration of its garbage and refuse.

"One of the arguments in favor of disposal by incineration rather than by reduction or by hog feeding is that incineration makes possible the material shortening of the garbage haul because several incinerators can be provided in well-planned garbage collection districts, whereas with either of the other two mentioned garbage disposal methods, the disposal plant must be located at the outskirts of the city or even beyond the city limits."*

The leading types of incinerators in use to-day in the United States are the Meldrum type, the Dutch oven type, and the Water-Jacketed Steel Construction type. Under the first comes the Meldrum incinerator itself, the Sterling incinerator and the Heenan-Froude furnace. The outstanding incinerator of this group is the Sterling, such as installed in Toronto, and which has recently been contracted for by Philadelphia. The Sterling furnace is an adaptation of the English type to American conditions. It is of the multiple cell type constructed with two or more grates in a single furnace chamber common to all grates. The ash pit for each furnace is separate, so that the burning on each grate as well as the air supply can be controlled independently. The special feature of this furnace is the type of grate and its setting. The furnace is designed for complete combustion without the use of additional fuel. It is usually designed for top feed, using a special patented charging device whereby the material is not permitted to come in contact with the heated surface of the furnace. The mixed garbage and rubbish are dropped from the charging device onto a shelf at the back of the furnace, in ¾-yard charges. The hot gases from the furnace chamber dry the refuse before it is drawn forward onto the grate by the stoker operating the furnace. Between 1,400 and 2,000 degrees Fahrenheit are developed in the combustion chamber.

The Dutch-Oven Type of incinerator includes the Nye, the Stokes and Superior incinerators and the modified Davis incinerator. The Nye incinerator, typical of the Dutch oven type, burns garbage and rubbish without ashes.

"It is practically square and is arranged to receive separately dry and wet refuse in a single large compartment. The refuse is dumped through two openings at the top and is burned on a concrete floor. One opening receives

* Engineering News-Record, August 3, 1922, page 172.

the dry material, such as rubbish or trash which drops through the chute immediately to the grate. The other receives the wet garbage, including water melon rind, night-soil and small dead animals. This latter material drops on a shallow pan where its surplus moisture is evaporated. The dried material is finally burned with the rubbish into which it has been raked.

"Care must be taken to have each kind of refuse uniformly mixed before it is dumped into the openings or otherwise great fluctuations in temperature will be felt, the lower temperatures being insufficient for combustion and resulting in odors of the fumes and smoke escaping from the stack.

"No attempt has been made to utilize the heat for generating steam from these furnaces. It is said that ordinarily no extra commercial fuel is used, as the heat of the burning rubbish is sufficient to drive the moisture from the wet garbage, but in some of the plants the combustion produces insufficient heat for the odorless incineration of the whole.

"Incinerators of this type are in operation in Jacksonville, Fla., Chattanooga, Tenn., Brunswick, Ga., Anniston, Ala., and other places."*

The only furnace of the Water-Jacketed Steel Construction Type is the Decarie, which was first built in 1901 in Minneapolis.

"The furnace receives the garbage in a crate of steel pipe suspended over the fire to effect the preliminary drying and prevent a packing of the mass. In order to make the steel pipes more durable, water is jacketed through them. Instead of fire brick sides, water jackets of steel are used, with the disadvantage of keeping the furnace temperature low and preventing the required high temperature combustion."†

One might mention a large number of other incinerators, variations and combinations of these types, including the Moss-Boulger in use at Richmond, Va., the Heenan-Froude in Milwaukee, Wisc., the Hunter-McGuire incinerators used in Chicago Heights, Ill., the E. M. Jones incinerator used in Mason City and other Iowa communities, the Lewis & Kitchen incinerator in Oak Park, Ill., the Bayless in St. Petersburg, Fla., the Griscom-Russell in Charleston, S. C., and the Sparks and Dixon furnace in Memphis, Tenn.

The Balmer Process of refuse incineration for garbage, ashes, rubbish, street sweepings and small animals is a new development in this country. The process is in successful use in South American cities, notably Montevideo, Uruguay, and contracts have recently been let for the construction of one of these incinerators

* Collection and Disposal of Municipal Refuse, Hering and Greeley, page 414.

† Collection and Disposal of Municipal Refuse, Hering and Greeley, page 313.

at Charleston, W. Va. I understand that the company installing this system was also the low bidder at Allentown, Pa., last week, although the contract has not been awarded as yet.

A Balmer plant consists of batteries of furnaces, each battery containing three fire grates, each about 6 x 7 feet under a common crown. Each battery has three mechanical feed hoppers, the discharge of which is controlled by the fireman by a hand wheel at the side of the corresponding furnace. The outstanding feature of the Balmer incinerator is the storage bins above the combustion chamber which serve as a reservoir for the day's refuse. These are closed hot air bins through which the radiant heat from the combustion chamber is evenly distributed. The forced blast unit which serves each battery is connected on the exhaust side with the corresponding storage bins, by means of appropriate piping and flues, thus the air supply necessary for the battery of furnaces must first pass through the storage bin, absorbing the vapors, fumes and gases generated by the heated refuse. In addition to this obvious advantage to combustion, it has been found that the garbage which is in a state of incipient putrefaction when it arrives at the plant, rapidly ferments, producing a large variety of alcohols and ethers at the expense of the water content. These carbohydrates, whether remaining in the garbage or passing off as vapor in the air supply to the furnaces, are a valuable aid to efficient combustion.

The Disposal of Garbage by Reduction is not economically applicable to places under 200,000 population, producing less than 100 tons of garbage per day. The principal reduction methods used in the United States are the Cobwell system at Syracuse, N. Y., and New Bedford, Mass., the Arnold system in Boston, Mass., the Chamberlain system in Cincinnati, Ohio, and Washington, D. C. In the process now used by the Pan American Feed Milling Company, the product is a feed for cattle and chickens.

The Cobwell process consists in placing the wet garbage in the reducer, a round flat bottom covered tank, flooding it with naphtha and then cooking under a pressure of about 85 pounds per square inch until dry.. Agitator arms in the tanks keep the material in motion. The dried garbage is then washed several times with gasoline to extract the grease completely. After crushing and screening, it is ready for sale as a fertilizer base. Recent improvements in the Cobwell system reduce the capital cost of the plant by one-half,

making it possible to install new plants at a slightly less cost than digester systems and the operating cost has been reduced about $1 per ton below the cost of present sanitary reduction methods. The period required to handle the material has been reduced from 18 hours to 7 hours and two to three times as much material can be handled per cycle, because of the reduction in the water content of the garbage by dehydrating before the material goes into the digesters.

The Arnold system of reducing garbage was the first one to practice the cooking of garbage with live steam. After the glass, rubbish and other undesirable material has been picked out, the garbage is dumped into vertical digesters, each holding about 8 tons. The garbage is then cooked from 5 to 8 hours under pressure with live steam. This thoroughly breaks up the garbage into a mass resembling a thick brown greasy soup, which is withdrawn from the bottom of the digester into receiving tanks from which, at the will of the operator, it is drawn into power press which separates the liquid from the solids. The liquids consist of grease and water which are again separated in a settling tank by gravity and the grease reduced to commercial form. The solid tankage enters steam jacketed dryers, is agitated, pulverized, dried, ground, screened and sold as a filler for fertilizer. In some of the later plants the solid matter coming from the dryers is treated a second time with a solvent, while passing through supplementary percolators or extractors, and an additional quantity of grease is withdrawn which increases the fertilizing value of the tankage. Plants of this type have been built and operated at Boston, Philadelphia, Baltimore and Rochester.

The Chamberlain or "liquid separating process" was first used in Detroit in 1898. Garbage is cooked in a special digester, the bottom of which is provided with perforated pressure cylinders. After the cooking period steam at high pressure enters the digester, so as to force the cylinders up and drive out the liquids carrying the grease. The water and grease which have been pressed out are separated by gravity and the solid matter is dried and otherwise prepared for the market. Plants of this type have also been built in Indianapolis, Cincinnati and Washington, D. C.

The process used by the Pan American Feed Milling Company in the production of meal from garbage, consists in taking ordinary city garbage, pressing it in a fertilizer dryer and cooking it

with superheated steam under 100 pounds pressure at a temperature of about 503 degrees Fahrenheit. The dryer has a 5-inch steel shaft running through the center with staggered paddles revolving at 14 revolutions per minute, agitating the mass in the dryer, so as to make it homogeneous. When drying is complete the material is emptied, screened and delivered to a belt leading to a grinder which reduces both bones and garbage to a uniform sized tankage. The products analyze 18 per cent protein, 5 per cent moisture, 12 per cent fat, about 13 per cent ash and bone phosphate, and 36 per cent carbohydrates. This makes an excellent feed for stock and poultry.

THE BECCARI SYSTEM of garbage disposal in zymothermic cells produces a fertilizer which is rather high in nitrates, phosphates and potash. A plant built after this system consists of concrete or brick cells, four to a unit, each cell measuring 8 x 9 x 10 feet inside dimensions. There is a trap door at the top of each cell through which the garbage is charged and another full-size sliding door at the side of each cell, through which the final product, an earthly humus, is removed at the end of the fermentation cycle, usually 30 to 40 days, depending on the character of the charge and the temperature of the outside atmosphere.

The bottom of the cell has a perforated concrete floor through which the liquids from the garbage drain into a pit. This flows to a central sump from which it is allowed to drain into the sewer or is pumped back over the fermenting garbage, should the latter become too dry. The maximum temperature of the fermenting garbage is approximately 140 to 150 degrees Fahrenheit, at which temperature the nitrifying bacteria are developed and denitrifying and pathogenic bacteria are destroyed.

The upper doors of the cells are water-sealed so that no odors escape. In the roof of each cell there is a small tower with baffles saturated with certain substances, which convert the gases of fermentation into sulphate of ammonia. Inside of the cells are shelf-like projections built around the side walls immediately under which are air passages through which air is permitted to circulate, bathing the whole mass in fresh air to accelerate fermentation. About 25 cubic yards of garbage are placed in a single cell, the shrinkage during fermentation being about 17 per cent, so that the final product is about 21 cubic yards. In computing the size of plant necessary for any given city, approxi-

mately one cell is allowed per 1,500 population or one unit of four cells to about 6,000 population in the United States. This system of garbage disposal was developed by Dr. Beccari in Italy and installed throughout that country at the beginning of the World War to produce the fertilizer necessary for the continuance of agriculture when the supply of German artificial fertilizer was cut off. An experimental plant of this type is now operating successfully in Paterson, N. J. The proponents of the Beccari system claim that it is the ideal plant for the disposal of putrescible waste, but there seems some doubt that it will be applicable to large cities where the large area necessary for the construction of the cells, in spite of the small capital outlay for the plant itself, will run up costs because of the length of haul.

Summary.

In this paper I have endeavored to summarize the garbage disposal problems in American cities, outlining the chief troubles experienced in collection and disposal. Municipal collection under the jurisdiction of the public works department is practically essential to the economic and satisfactory solution of the problem. I have outlined the limitations of the various disposal processes, giving more attention to the methods which have proved more successful and calling attention to new processes which seem to hold hopes for the better solution of some of our troubles.

As engineers, city officials and citizens who may be called upon to report on new disposal methods or possible changes in the present disposal methods in use in your cities, I would caution you to investigate slowly and thoroughly, and act honorably and conservatively with the best interest of the entire community in mind. Remember that garbage collection and disposal are primarily services of convenience and secondarily of health, and they are essentially services which the city should perform itself as an engineering function.

DISCUSSION.

Mr. J. Frederick Jackson: We are much indebted to Mr. Kendall for his comprehensive treatment of the subject. The problems with which the sanitary engineer has to deal, in these days, lead him into close association not only with civil engineering problems, but also with chemical, mechanical and transportation problems. Anyone who has looked into these matters will

be struck forcibly by one point which Mr. Kendall has brought out, and that is the confusion encountered when following up the plants that have been installed and then so quickly abandoned. It seems to me he has sounded a note of warning against too much haste in rushing into these problems.

There is urge of public opinion for conservation of waste. Practically all processes of waste treatment now, to be successful, must show some salvage value. The sanitary engineer is confronted with the question of providing a satisfactory water supply and of disposing of domestic and industrial waste, refuse and garbage, and to do it it as economically as he can with the means at his command.

There is no question but that the problem of refuse and garbage disposal should be administered by the Department of Public Works, but I rather take exception to the statement that it is not a health problem, especially if you have to collect and dispose of garbage as it is done in many places, and if the reaction and complaints of those living near to where the garbage is disposed of, is any criterion. In such circumstances I should think it might be classed as a health problem.

Mr. Kendall. It is merely aesthetic.

Mr. Jackson: If you could listen to some of the conversations I have heard over the telephone, or to the people who come to see me, or read the letters I receive, I think you would admit that their blood pressure and perhaps their nervous systems were seriously affected.

Mr. Kendall: Do you find that any of them are really made ill by it? They may say they are, but have you proved it?

Mr. Jackson: I have had them say they were. I did not follow it up. I have had them say they vomited up their dinners, etc. Aside from that, I think there is a health side to it.

Mr. Kendall. I admit there is a health side to it. But I think primarily garbage collection and disposal is a service of convenience, rather than of health.

Mr. Peck: Can Mr. Kendall give us anything on plant cost of these various places he has referred to?

Mr. Kendall: That is difficult to discuss. I am gradually accumulating some reliable cost data on municipal collection and disposal, but they are not in shape for presentation as yet.

Mr. Price: Are we to understand that you would remove from the department of health the powers of control and regulation it now has?

Mr. Kendall: By no means. But the actual work should be under the Public Works Department.

Mr. Trowbridge: I have seen an account in the Engineering News of a sanitary fill system in Seattle. Can you tell us about that?

Mr. Kendall: From disinterested observers I learn that they have had practically no trouble with the sanitary fill in Seattle. Dumping is likely to cause a good deal of odor. There is a difference between dumping and strictly sanitary fill. Two or three other cities on the Pacific coast are now using sanitary fill, rather than installing reduction or incinerating plants.

Mr. Kellogg: Can that sanitary fill be carried on in winter?

MR. KENDALL. Yes. The Beccari fermentation system was developed in Italy where they do not have very cold winters. Last fall a plant was installed in Paterson, New Jersey. There was some question as to how it would operate. A truck would come in and dump a solid frozen cake of garbage. This was melted by the heat of fermentation and the process worked admirably, reducing the garbage to humus in about 40 days.

(Question) Was any artificial heat used in that system?

MR. KENDALL. None whatever. The garbage is dumped into the concrete cell and sealed up.

(Question) What does it do to the concrete?

MR. KENDALL: In Italy it has not done anything, in the last five or six years. What it may do, we must wait and see. I know several of the engineers connected with the new American Beccari Company who are very enthusiastic over it, and I think rightfully. I think it is particularly applicable to smaller communities, rather than to large cities, although it can be installed, the capital outlay being relatively small, in comparatively small units in each one of the collection districts of a city, thereby reducing the haul, which is one of the biggest factors in garbage disposal.

THE TOMLINSON BRIDGE AT NEW HAVEN*

Edward S. Nettleton, Member Connecticut Society of Civil Engineers, City Engineer, New Haven, Conn.

When the suggestion was made to me, that I speak to you on the subject of the Tomlinson Bridge, I hesitated about doing so, not wishing to inflict myself upon you. On reflection, however, I was reminded of a story which seemed to fit the occasion.

We are told that two Irishmen were one day walking along a country road, when a gust of wind blew off the hat of one of these sturdy sons of Erin. The hat bounded across the fields and finally fell into a well. The hat being a good one, Patrick felt that he must recover it. The two men discussed methods of procedure, at last deciding that Patrick should be let down into the well with a rope held by his companion. The well proved to be deeper than was expected and Patrick became frightened and called to his friend to pull him up. His voice was not heard, however, so with one last desperate cry he yelled, "If you don't stop, I'll cut the rope."

It occurred to me that talks on occasions like this are really the bonds which hold us together as a society, and that to neglect an opportunity to address you would tend to sever those bonds. So if you will bear with me for a short while I will try to tell you something about the first Tomlinson Bridge; the second one which we have just removed, and the one which we hope to be able to throw open to the public in about a year's time.

If you were to study the situation of New Haven as shown on a map you would note that it is located at the head of a bay or harbor some four miles from Long Island Sound. Into that bay there discharge three rivers: West River, Mill River and the Quinnipiac River, all of which flow through New Haven on their way to tide water. Many bridges span these rivers, five of them being some type of a drawbridge.

At the confluence of the Mill and the Quinnipiac Rivers is located Tomlinson Bridge, known when first built as "Harbor

* Presented at meeting of Feb. 21, 1923.

Bridge." When Harbor Bridge was built in 1797 the distance between shores was a full half mile. As the years passed the shallow waters at the ends of the bridge were filled with earth, so that today we find the river banks only 1400 feet apart.

The need of a bridge at this point was evident early in the history of New Haven. People from East Haven and from the Parishes beyond would ride to a point on the easterly bank of the river, situated just north of the location of the proposed bridge. There the colonists would leave their horses or oxen, stabling them, and would cross by ferry to the westerly shore and would reach New Haven as best they could, returning when they had bartered their farming products for such goods as they might choose. This place received the name of Stable Point. The only bridge across the Quinnipiac was at Middletown Avenue, nearly two miles further north, reached by a rough and crooked highway.

Such conditions appealed strongly to a few shrewd East Haven men, who saw an opportunity to add to their wealth by providing a bridge near Stable Point and charging toll over it.

A charter to build the bridge was secured and the structure was erected in 1797. A picture of the bridge woud show a structure consisting of a causeway of stone at each end about one-eighth of a mile long and a pile and timber trestle with a drawbridge in the middle connecting those causeways.

The bridge had been in use not more than five years before the toredo got busy and the piling had to be replaced. Other troubles beset the company from time to time, so that the operation of the bridge was far from a financial success.

In 1807 occurred what was known as the great deluge. It swept the whole thing away. Not discouraged, the company rebuilt, extending the stone portion further on each side and leaving a thirty foot opening in the middle. Matters went along very well then until 1842, when the company was obliged to widen its bridge opening, giving a clear waterway of seventy feet.

An early picture taken about 1860 shows much animation around the westerly entrance to the bridge at the steamboat landing. In those days a very popular method of travel to and from New York was by steamboat, and the departure or the arrival of a boat was the occasion of great activity.

The bridge draw consisted of two cantilever sections, operated by two men, one at each end. The piers supporting the spans

were huge in proportion to the weight which they carried. They were forty feet square and so spaced that the result was that they made what was in effect a dam in the river. Their existence caused a very swift current on the ebb and flow of tides, giving trouble to shipping when passing through the bridge. Another serious handicap to the successful operation of the bridge was the small income from the tolls. The rates were interesting. The charge for a horse was five cents; for a mule four cents. Foot passengers could cross for one cent. A double team enriched the company to the amount of ten cents, if the wagon was empty; if it was filled, sixteen cents was the charge.

A plan was adopted of auctioning the tolls for a coming year. A gamble of that sort was, at least, exciting, if not always profitable. In 1810 the Profits sold for $1500. Twice the company was given permission to increase the tolls, in efforts to keep from bankruptcy. The added cost to the public in using the bridge, without doubt, caused many to cross the river by other bridges which were free.

The opening of the Ferry Street bridge in 1878 further reduced the number of people who found Tomlinson Bridge of sufficient convenience to make the payment of toll worth while.

A gentleman who lives on Forbes Avenue and near the bridge recently told me that he spent sixty dollars for crossing the bridge during the last year that it remained a toll bridge.

As the years passed, the old covered structure became more and more dilapidated, though perhaps interesting to artists. An etching by Robert Wiseman shows the affair very faithfully. An amusing criticism of his picture, which shows a load of hay going towards East Haven, has been heard. "Whoever knew of a load of hay being taken to East Haven," asks the critic, "It's like taking coals to Newcastle."

The demands for a bridge more suitable for the needs of the location increased. Both land and water travel were inconvenienced beyond reasonable endurance. The Legislature then ordered the bridge company to replace the covered bridge with one having a roadway at least twenty feet wide and with a waterway not less than eighty feet in the clear. All was to be accomplished before December, 1885.

The order was fulfilled by purchasing from The New York, New Haven and Hartford Railroad Company a portion of the

bridge then recently discarded, which had spanned the Housatonic River between Milford and Stratford. This gave a twenty-one foot roadway and a draw eighty-four feet wide. The old forty foot piers (except the two westerly ones) were removed. Conditions were much improved. The swift current was greatly reduced and more convenience afforded to those crossing the bridge. The acquisition of a better bridge by those interested did not allay the demand that the bridge should be free. The agitation started some years previous to have the tolls removed grew in intensity until there was no alternative other than for the City to buy the bridge. The purchase was made in December, 1887, and on January 1, 1888, it became a free bridge.

Much celebrating was indulged in by the residents of East Haven and of New Haven Annex so-called, over the good fortune of being able to take the "short cut" to Town without being obliged to "shell out" a few coppers or dimes while crossing Tomlinson.

The question may be asked, "Why is the bridge called Tomlinson Bridge?" One story has it that one Tomlinson was the contractor who built the bridge. The probable reason is that Isaac Tomlinson was the largest stockholder in the company. The stock was divided into 6000 shares and Tomlinson owned half of them. He seems to have been a public-spirited man. He lived on the harbor front at a point where Hamilton and Water Streets now meet. There was no highway along the waterfront to the new bridge, so he laid out what is now Water Street. He also built a wharf which was also named after him.

Matters went along fairly well until 1904, when the Manufacturers' Railway secured the right to cross the bridge. A single track for use of an electric railway had been in place since 1893, but to allow freight cars to be taken over the cast iron structure required that it be somewhat strengthened. Although for many years the members of the trusses had withstood the strains of passing trains, the character of their material and the increased weight of freight cars necessitated safety measures. The fixed span chiefly received attention. This one span was divided into three lengths by placing two plate girders at the proper distances to support the bottom chord. The girders were carried by piles surrounded by concrete and the whole encased in a 24-inch cast iron pipe which was carried down to hard bottom.

That construction afforded sufficient strength so that no fear was felt for consequences in operating heavy electric locomotives drawing fully loaded cars.

A short time previously the operating power for the draw span was changed from steam to electricity and the operator's house was removed from the floor of the draw and placed overhead and carried by the gallows frame.

For carrying the traffic of twenty years ago, no serious objection could be stated against the use of the bridge. As travel increased and especially due to the larger number of automobiles every year was the bridge found more and more unsuited for the purpose which it was expected to fulfill. The lack of sidewalks made the use of the bridge by pedestrians hazardous. Many times people walking were obliged to climb upon the railing at the sides to avoid being struck by an automobile.

Westerly of the draw span was a portion of the old bridge, consisting of two short wooden trusses carried by two of the old forty foot piers. An attempt was made to have another span of the cast iron trusses placed there but the suggestion was never carried out. The old piers became so unsightly and were so lacking in cement in bonding the masonry that there seemed imminent danger that the piers would utterly fail. All those objections helped in strengthening the demand for a modern bridge of such design that all needs would be met.

Accordingly in 1913 the Board of Aldermen, acting upon petition, provided a bond issue of $250,000 for a new bridge. That amount was wholly inadequate and the matter remained unsettled until 1916, when Mr. Ernest Wiggin was commissioned to draw plans for a suitable bridge to be built at the site of the old one. The plans were completed, but as no increase in the amount of the appropriation had been made, the plans were put aside until a favorable time should be found for securing more money.

In 1921, the request was made of the Board of Aldermen that an additional amount of $900,000 be granted, to be used for the construction of a new Tomlinson Bridge and to pay for all damages to abutting property because of changes in lines and grades.

After many hearings before the proper committees the money was secured and the contract awarded. C. W. Blakeslee & Sons of New Haven were the successful bidders.

The comments made at various times by people interested are amusing. They remind one of a story told of life in the Scottish Highlands. It is said that no Scotsman wishes to be considered a "Highlander." Should you travel through the Highlands and ask, "Where are the highlands?" you would be told, "Just beyond" or "Just a little further." And so you travel along receiving the same answer. Finally you are told that "They are just back a ways." You never seem to find them. So it was with the building of a new bridge. Some years ago people said that we must build a new bridge soon, and so matters drifted along year after year until finally it was declared that the old bridge should have been replaced by a new one years ago. Never would the people admit that the proper time was *now*.

After the contract was signed in July, 1922, the work advanced rapidly. Included in the contract was the building of a temporary bridge a little to the north of the old bridge and the site of the new. The industrial interests along the easterly side of the harbor demanded that rail service be maintained, so that both raw materials and manufactured goods could be satisfactorily moved. In order to satisfy those interests as well as to provide for a moderate amount of vehicular traffic, a pile and timber trestle was constructed and the old draw span moved so as to form a part of the whole. The total length of the temporary bridge is nearly 1000 feet. Eight hundred piles were used, placed in bents 15 feet apart with 8 piles to a bent. A total of 41 piles was used to support the draw span.

Much comment was caused when it became known that the old draw span was to be moved a hundred and twenty-five feet or more, and to be placed on a pile and timber support. The ever present calamity howlers gave expression to their ideas, saying that "It can't be done." "The cast iron members of the trusses will be overstrained and will break." "The support for the draw will not be sufficient for the strain of operating," etc., etc.

Notwithstanding all the dire predictions, the work went forward. The draw was jacked up about five feet and was placed upon wooden rollers, some eighty or more being used. Block and falls were then attached to the drum of the draw, one set on either side. The other ends were hitched to a pile driver engine and, exercising proper care, the whole affair, weighing nearly 300 tons, was pulled along the old fender pier, somewhat strengthened, 126 feet to the

new position. The time required was about eight hours. The "would have it wrecked contingent" nearly gained their point just before the span was moved. A barge going down the river in tow of a tug became unmanageable, due to tide and wind, and striking the fender pier crashed through it and hit the end of the draw. The end posts on either side were broken. The ends sagged about eighteen inches, bending the rods of the lower chord seriously. The broken posts were removed and a sleeve placed in each and by means of an acetylene torch they were welded as strong as when new.

The number of openings of the draw for the passing of vessels are many during the year. The total has run up to as high as 17,000 times. The oyster industry, though waning, is still vigorous and in crossing the bridge, should you look either up or down stream, you would very likely see an oyster boat about to enter or leave the river.

It is astonishing that along toward the middle of the Eighteenth Century the yield of oysters from the beds of the Quinnipiac River amounted to 400,000 to 500,000 bushels yearly. The alleged pollution of the harbor is said to prevent the growth of the bivalves in that location now. Were it possible to bring the waters to crystal purity it would be scarcely believable that such enormous quantities would ever again be found there.

To allow for growth of commerce using large carriers, the new bridge will have a clear opening for draw span of 126 feet. Government requirements are 125 feet. Other facts concerning the new structure are,—length, 550 feet; width, 61½ feet. There are three arches either side of the lift span, to be constructed of steel girders encased in "Gunite." The lift is to be in two levers and will be of the Strauss Trunion Bascule type.

In making soundings or borings rock was found on the easterly side of the channel at about 60 feet below mean high water, while on the westerly side the sand and gravel went to a depth of nearly 80 feet. It seemed unnecessary to go to bed rock with the foundations, the overlying clay and gravel furnishing suitable bearing for piling. Piling is, therefore, being driven and cut off in some cases—as in the bascule piers—at about minus 34 feet.

The whole number of piles to be used is above 1800. Those sturdy logs will support over 14,000 cubic yards of concrete. There will be required over 1,800 cubic yards of stone masonry and

about 1,326 tons of steel will be used. The roadway, which will be forty-two feet wide, will carry two tracks on twelve foot centers, capable of supporting two trains of freight cars over their entire length, the loaded cars to weigh 200,000 pounds.

The maximum time allowed for opening and closing the lift span is fifty-five seconds.

Progress in construction is advancing at a rate such as to give promise that the formal opening of the bridge to public travel will be in the summer of 1924.

Soon after the bids were called for, an animated discussion sprung up over the question whether granite or East Haven sandstone had best be used for facing the piers and the retaining walls. While the specifications called for Stony Creek granite or its equal, many favored the use of the East Haven stone because it would mean a saving in costs, and would prove to be highly durable. It was pointed out that the piers of the first bridge were of sandstone and had been subjected to the action of tides and weather for over a hundred years without apparent erosion or deterioration of any sort. Furthermore, a block of the stone subjected to an analysis was declared to be more durable than granite. Such statements and the fact that the quarrying and the cutting of the stone would give employment to local labor carried much weight in favor of adopting the stone for the work. Upon calculation it was found that its use would mean a saving of over thirty thousand dollars. Therefore East Haven sandstone is to be given another test for durability in construction work.

The completion of the work together with the building of the bridge and approaches over the railroad crossing at Bridge and Water Streets will form a notable achievement in the progress of the city towards the betterment of traffic leaving or entering the eastern portion.

The growth and development of the old fifteenth ward, which, without doubt, was retarded by the existence of the toll bridge, has progressed surprisingly during the past twenty-five years. Tremendous impetus will be given the boom, already under way, along the east shore when trolley passengers and automobiles are able to use the "short cut" across Tomlinson Bridge to reach their destination. With the Manufacturers' Railroad connecting the Belle Dock freight yards, the area southerly of Forbes Avenue is destined to become an industrial district. Much inducement will

be offered to manufacturing interests to locate there. The advantages of being near the business portion of the city and having both rail and water transportation are so unusual as to be not overlooked by those seeking suitable locations for factories.

The thought often comes to mind during the progress of the work as to how long this structure, which we are now so carefully erecting, will endure. Will it stand for a century? Probably not! We are inclined to speak laughingly of the results in bridge construction fifty years ago. While we are putting our greatest skill in our work of to-day, it will receive commendation or even passing attention fifty or more years hence? No doubt but that engineers of the future will look upon our creations with amusement. It is to be hoped that engineering science and skill will so advance that what *we* are able to do, posterity will hold as diminutive indeed.

QUALITY CONTROL IN SILK MAKING*

By Hibbard S. Busby, Research Colorist, Cheney Brothers, Manchester, Conn.

Part I.

Your President has asked me to show you some of the work which I have done in building up a department for the improvement and control of quality and finish in manufacturing silk.

In the course of this demonstration I wish to show you many illustrations of the problems (and solutions) which are encountered in such a project as this, but the essential background of such a display is that I stress for you the fundamental importance of the economic foundation which:

1. Makes it possible
2. Demands such an effort
3. Determines its importance

It is just possible that you may appreciate more deeply, therefrom, the difficulties in the manufacture of product which must be rated by the degree of its fineness, and, as well, be sensible of the degree to which this science of quality control has been analyzed and advanced.

No business of the sort I mention, now existing, can hope for a future of promise and prosperity except in so far as it heeds the warning to:

> "Grow and never cease to grow,
> For when growth ceases death begins."
>
> "It is the law, And all the laws are just,
> Oh—(*that*)—shall walk these streets when you are dust!"

In a closely competitive market it is extremely difficult, and calls for business courage and vision of the highest order, to underwrite the sort of an investigation and installation I shall describe; it is by its very existence sufficient evidence of complete realization of the challenge of the future and the American market, (that is, of you and me.) It is, as well, clear proof of the steady increase of ideals in commercial work and of keeping faith with man and man;

---

* Presented at the meeting of February 20, 1923.

"For only he who *breaks* the faith shall die
And moulder with his body bye and bye.
While he who *keeps* the faith shall come again
And tread the earth among the sons of men."

The responsibility (in commercial relations) of the man or woman of ideals is that he shall so perfect his plan that, regardless of the initial (or even continual) outlay required for performance of it (to quote successful authority), he should make his research "an addition to and a part of the business organization" and do it in such manner that the additional cost to manufacture thus created shall:

1. Bring more works of higher quality to a larger market than heretofore, and
2. Add a security of quality and a consequent enhanced value, to the product, that will guarantee an increased period of demand, or make the product of such value to the potential purchaser as to secure his willingness and ability to a higher price therefor.

In either case "quality-cost" will be absorbed as an asset of the business, and may be written off on the extension of the marketability of the product that is thus created.

Upon this economic corner-stone we may erect a structure of expansion in the service of the purchaser's ideals.

If I may quote again:

"The high schools, universities, fashion magazines, and even the moving-picture industry have ingrained into the younger generation a conception of art standards, that while limited in scope, is high enough to be able to recognize acceptable conventions to the rejection of what is considered as either old-fashioned or in bad taste."

Moreover we have also a condition to reckon with that we may find the best artistic expression of America's future through the channels of commercial art, and inspired (and tested) super-standards of production; the genius of the advertising artist has already created a potential market, of which mere keeping up with the game demands satisfaction. Therein do we see the absolute necessity for the limit of bravery in the application of our ideals,—indeed the problem is rather one of so developing our capacities, as we have the talent, to be ready and prepared for the time when their certain instant execution is demanded of us.

Fundamentally, in all our concepts we are dependent upon creative imagination and the higher inspiration which is available only (and after) long preparation in background, in breadth of viewpoint, and within.

Whether, indeed, we achieve our result by deduction, by mathematical synthesis, or through infinitely painstaking observation of the lavish "chef-d'ouvres" of nature the result is the same, for:

"A haze on the fair horizon,
The infinite, tender sky,
The ripe, rich tint of the cornfields,
And the wild geese sailing high—
And all over upland and lowland
The charm of the goldenrod—
Some of us call it autumn
And others call it God."

Part II.

In order that we may prove our work, (and for the benefit of the fair-minded skeptic) display our results to the eye of the beholder, we must do more than merely state a proposition or formulate a beautiful conception: We must also:

1. Reduce our proposal to terms of mathematical, or other methods of approved scientific analysis, and
2. Demonstrate, by the parallelism of graphically recorded data and observed existing fact that (1) the measurement measures, (2) the combination combines as specified or predicted, and (3) that the data secured and properly classified brings about (when intelligently applied) the desired result.

Gentlemen, this is a subject which is not, as yet, being completely illustrated on the printed page, because while our determinations can be studied and scientifically analyzed, defects adjusted, and results recorded mathematically, the printer himself has only begun to learn the possibilities therein, and the methods of application, which we are producing for his *benefit* and *assistance*.

I will show you examples and graphical records of the principles and practice of which I speak, and then discuss for you the state to which the handler of process—the craftsman—has progressed in making use of them.

The earlier stages of the art of studying and recording the phenomena of appearance of colored objects, and reducing this data into its elementary constituents, was developed first in the pigment and textile industries.

Chevreul, in France, began to classify the many hued samples of threads which he encountered in his researches for the silk makers of Lyons,—and Maxwell, from another angle, began to study into the nature and form of color differences. Chevreul evolved his famous scales and maps of color, probably the earliest known classic of that difficult art. Maxwell, on the other hand, developed the mathematical study of color relations and recorded the first graphical diagram of colors, developing and proving his relations from the spinning disk which bears his name. Various workers of the nineteenth and twentieth centuries amplified the work, there were contributions optical, and methods instrumental, as well as the formulation of laws of physiological and psychological reactions—until to-day the literature is most voluminous and particularized. DeAbney, in connection with photographic researches, showed us the way to the complete graphical specification of a colored object and during all this growth the mighty work of Helmholtz clarified the thought and made an orderly scientific foundation upon which to build the tower which was to come. Then America's scientific development began to be felt, and the art was improved and many advancements brought in by Rood, A. H. Munsell, Michaelson and others. America's mechanical genius was an inevitable addition to this art. Howland's disk photometer, together with his geometrical space descriptions of color, Rood's flicker photometer, and many other specialized color instruments testify to the efforts of this period, which still continues.

Notable among scientific contributions to the practical science of the art are the color index of Ridgeway, the studies or organic materials made by Mulliken, the hue sensitory scale of Jones, the contributions to notation made by Ives, Nutting's optical contributions, the classification and compilation work of Troland (together with his physiological studies,) Priest's investigations in the field of color sensation, Jorgensen's reproductions of spectral colors, and the continued program (of at least three prominent engineering societies in America) for the furtherance of this art. It is doubtful if a single, even though fairly large book could properly

evaluate the contributions of the workers in America alone, in this field.

The principle of spinning-disk measurement of color has been amplified so as to adapt the results of these measurements to a peculiar industrial demand, and we now have records showing the graphical relations of one color to others in a group, together with the means for allocating by numbered designations the differences between the members of the group. Inspection of the colored samples measured will bear out that these number-differences are a true representation of the facts of the color appearance.

It is frequently desirable to learn, from time to time, the nature and degree of color variations exercised by a product under different conditions of manufacture. That this is possible to a degree beyond the limits of the unaided eye's perception is demonstrated by examples shown, and the plot of their *"absolute"* color differences. The contention that "inasmuch as the eye is the ultimate judge of color any measurement more refined in degree than that of which the unaided eye is capable is of no value" is completely negatived by the facts in such cases as those shown, as from these measurements results of a quantitative economic value were obtained (which were borne out by large-scale works experiment) supporting the nature and degree of the determinations. The measurement methods are continually called upon for such determinations, (estimates by the unaided eye in work of this kind being of uncertain, and often misleading results.) Two sets of data are here submitted to show the unreliability of the unaided eye as compared to precise methods of measurement.

With the unaided eye (7 experienced observers making the examinations) the record of agreement with the readings was as follows:

56.1% of observations in agreement with measurements
20.3% of observations not detecting any quality difference
23.6% of observations in disagreement with measurements.

Where the nature and physiological reactions to color are a part of the problem it is desirable to make the determinations in terms of fundamental physical constants, i. e., readings in terms of the colors of the spectrum. For this purpose it is necessary to adapt the principle of the spectroscope to our needs, and to that end the spectroscope becomes a colorimeter.

Involved in this entire problem of standardization and measurement is the vital matter of uniformity of lighting conditions, the duplication of artificial light of all kinds and of natural daylight. The choice of types, power, location, etc., of these with respect to work being inspected for quality rating, and where the demand is for a high order of visual acuity and the agreement in uniformity of the general manufacturing problems to that in the laboratory is another phase of this problem which must be met perpetually.

The finishes, or sheens and texture of goods must be classified and prorated, and means provided for rapidly and efficiently detecting their peculiarities.

The question of selection and inspection of raw materials from the point of view of

Properties

Cost

Adaptability

is a vital function of this testing, as from such a threefold type of inspection are made up the most efficient specifications by means of which raw stock and coloring and finishing materials are combined in the best manner. Particularly is this true in the selections of types of pigments and dyes, and the testing for such of their properties as fastness to light. New developments and methods, as well as discoveries, are continually being brought out by these methods and continually widening amplifications of the scope of their usefulness results.

Indeed the literature and practice of the art presents so many new phases of hopeful practical outlet that the worker is compelled to develop the academic side of them in his own (supposed) leisure, and bring them into his program as quickly as he is able to effect practical outlets for these purely scientific phases of the problem. The practical demand treads closely upon and makes continual requisition of the advancements in the realm of pure science thus evolved.

We hear much talk of "truth-in-fabric" these days. There is another truth with which we are vitally concerned—the truthful reproduction of the artist's conception into the manufactured product, and then the truthful representation of the beauty of this product in the printed advertisement. This problem is all one of

the materials, the color science, and the art of bringing these factors to a focus into an harmonious result.

The subtle yet highly important knowledge of what makes style and saleable color criteria are being reduced to an exact science in many fields, and with accurate fact-knowledge an ever increasing quantity of the speculative element is being removed from this division of labor. A substitute has *not* been found for good taste (as some of the spurious affirmers of this work would have us believe) but "in every way we are approaching more and more closely in our estimates to the true advance prediction of the human response (as reflected in public demand) to those desirable and acceptable appearance-of-the-goods qualities which place merchandise with assurance."

The boundaries of the scope of this subject exist only in the boundaries of the imagination of the directing authority for the program. It is a research, control, inspection, classification, detection, synthesis, and creative art.

* * * * *

Only a few of the myriad applications of this science are here presented to you, just as, in the brief time in which industry has already sponsored this art has it been possible to present them as fully fashioned products for industrial usage. These and other industrial applications now embrace a field of more than half a hundred industries, however, and there is no final limit, to this list, in sight.

The learned physician of Louis XV fell into the error of rating Boile as a quack because of his attributing diseases to germs, and affirming that he had seen these germs under his "sorcerer's instrument" the microscope. The arraignment is now amusing:

> "These are the tricks which that dexterous and cunning charlatan had the impudence to display in a century as enlightened and learned in physical science as ours is, and in a city such as Paris, filled with so many able people. I do not know what he expected to gain by his trickeries, but I do know that he had the prudence to avoid by flight the punishment he deserved. As soon as he became aware that his tricks were discovered he disappeared. It is thus that one exposes the fictions about which some people had allowed themselves to become infatuated, and medical science, luckily avenged, was restored in its former laws."

("One must go on.")

One principle only must be the guide and responsibility in such an effort as this:

"Gently make haste, of labor not afraid,
A hundred times consider what you've said,
Polish, repolish, every color lay,
And sometimes add, but oftener take away."

"Till old experience do attain
To something like prophetic strain."

"I paint the cot
As truth will paint it, and as Bards will not."

RELATION OF ENGINEERING TO FIRE INSURANCE*

Frederick C. Moore, Asst. Secretary of Hartford Fire Insurance Co.

The average man thinks the only purpose of fire insurance is paying losses due to fire. He doesn't bother his head about where the money comes from. The insurance companies furnish it in some mysterious way.

If he thinks seriously, it soon becomes apparent that the money comes from the public, which pays the bills for everything ultimately, and that all the insurance company does is to collect and disburse what the public pays in.

The fire loss, therefore, is a direct tax on the people, for which they get no return because the destruction of property by fire is practically a complete loss of value. There is no equivalent in public buildings, in better waterways or roads, or in other public improvements. The money value goes up in smoke.

Last year the total insurance loss paid in the United States was $390,000,000, equal to $3.55 per capita. Every individual pays his share of it directly or indirectly, for although the companies collect the money in the shape of premiums on policies from those who insure,—the butcher, the grocer, the clothier, everybody who has anything to sell, passes on his share to the buyer in the price of the goods. Every one of us is therefore directly interested to see fire losses decrease.

The insurance companies are also working to protect the country against the fire waste by doing everything they can to reduce it. They recognize their responsibility not only to pay losses but to reduce them. It is in this latter work that engineering is related to fire insurance.

Companies like those in this city insure the owners of all kinds of property, so that they deal with all sorts of hazards, every type of construction, under conditions of fire protection varying from none to the best. In determining the hazards and their control, in the endeavor to improve construction, and in the maintenance

* Presented at the meeting of February 21, 1923.

and perfection of fire protection of every kind, the judgment of the engineer has played an important part.

The men in fire insurance who deal with the engineering work are in large part graduates of the engineering schools who become inspectors for organizations which make rates, for bureaus which issue inspection reports, or for companies. Among them are men from all the engineering courses.

In whichever branch of the business they may be, their work, generally speaking, is making a detailed examination of insured property, usually those factories and mercantile plants of sufficient value to warrant the expense, reporting principally on construction, the nature and hazards of occupancy, the danger from exposure to neighboring plants, the kind of protection available when fire occurs, not only that which is provided by the owner but the public protection of the community.

Such inspections are carried on along very similar lines everywhere, the bureaus generally using a uniform inspection blank in order to simplify the reading of their reports by the examiners in the company offices.

By the aid of such reports the rates are made and each company determines how much it will risk on each property.

Broadening the consideration to whole cities, these are examined for grading on the same principles as individual risks, giving special consideration to the nature of the congested centers; to fire department and water works, testing the working of each; to the construction; and a comparative numerical rating given to each city, which governs the foundation or basis rate for insurance there, to which is added whatever the conditions at the individual risk may warrant.

The men in this sort of work are, as a rule, members of the National Fire Protection Association, an organization now about thirty years old, which also admits to membership others interested in such work.

By means of special committees every phase of construction, hazard and protection, and the devices and materials thereof, are investigated, discussed, and rules and specifications drawn from the standpoint of the fire insurance business, for the guidance of those concerned in the use and manufacture of those things.

As the membership covers the whole United States and Canada,

country-wide experience is available and the results consider all conditions likely to be met.

Out of the need developed by the discussions of the N. F. P. A., as it is called, grew a testing laboratory, to determine the fitness of a device or a material for use according to the standards laid down by the N. F. P. A. This is the Underwriters' Laboratories, Incorporated, which now has at Chicago a large, well equipped plant, with smaller stations at other places and inspectors who examine the method of manufacture at the factories where the things tested are made. The evidence of approval is generally shown by a label of the Laboratories applied to each device or to unit quantities of the materials approved. This is a sign that the product conforms to the standard established for the protection of the public.

As a result of the inspection of properties constructive criticism is always made, with the object of making the risk safer against the chance of fire, limiting its extent, and making more certain its extinguishment.

If there were no fires there could be no fire losses, therefore the logical thing to do first is to prevent fires.

To do this most effectively the conditions which cause fires must be known and although there are hazards common to most plants, such as those of heating and lighting, there are special hazards peculiar to each industry.

Almost every fire, except the insignificant ones, is reported in detail by an inspector and his report is usually given also to the statistical department of the N. F. P. A. where it is classified according to cause, but also under the industry and the process in which it occurred.

The results are studied and analyzed for each kind of risk, so that the number of fires occurring in each different process is known. Thus the most hazardous operations are identified.

Then these fires are studied individually and the particular machine or material making the trouble is found out and the cause detected. Such analysis has repeatedly resulted in changes of design. The iron beater arms of cotton pickers, revolving at high speed, struck sparks in contact with nuts and other iron parts that got in with the cotton, so phosphor bronze arms were substituted, which do not strike sparks.

A new machine dryer used for dyed cotton and other textile fibres was the seat of many fires. Their place of origin was discovered to be a small blind space beneath the perforated table on which the stock was carried, into which litter and some oil dropped and accumulated in this unknown place until spontaneous ignition occurred. An outside door was provided for access to this space, proper instructions for cleaning observed, and the fires ceased.

Such cases might be quoted in great variety. The hazards of every method and every process are studied and the knowledge gained is disseminated and used for the common good.

Such an analysis plainly shows what are the dangerous places. For the purpose of illustration we will take cotton mills, a class very closely studied. The record of 4510 fires shows that 52.5% started in the pickers.

Unmistakably, the picker room is the most dangerous part of the mill. It therefore follows that this process must be so located and separated from the adjoining property, that these numerous fires cannot escape to damage any other part. This establishes the principle of identifying and segregating a serious hazard.

85.6% of the fires in cotton mills are due to the special hazards of the processes. Only 4.9% are due to processes subsequent to the manufacture of yarn, so that it is proven that a mill working cotton which buys its yarn and carries on only the subsequent processes is a far safer mill, other things being equal, than the mill which starts with the raw cotton and carries on all the processes.

Nearly all the ordinary industries and in addition the hazards of many materials and processes have been examined in an exhaustive way.

Another material result of the knowledge gained from these sources is the ability to recognize the degree of hazard involved in any process or operation. Consequently a property owner is often advised against some location for it, where it would expose high values or fire be difficult of control.

Since we cannot hope to prevent entirely the occurrence of fire, it is necessary to consider means of limiting the spread of it, not only within a building, but in a city, a lumber yard, a forest, or any place where congestion of values or accumulation of combustible material requires it.

The simplest method is by the maintenance of a clear space of sufficient distance to forbid the passage of fire or at least to diminish the chance of such an occurrence. This is sometimes possible in the country, but not in the cities, where buildings must stand side by side.

Dependence must there be placed on walls, the protection of windows and doorways, and the imperviousness of floors both to fire and to water, and a careful comparison of the experience with different methods in fires is part of the work.

Walls of refractory materials such as bricks are what we think of in such a connection, but in the lumber mill districts of the Pacific Coast there are high walls built of 4″ lumber properly braced on the unexposed side, which, taking into consideration the protection available, were very effective for their purpose.

It is possible to build effective barriers to fire if to non-combustible walls and roof be added the limitation of small windows and few of them, protected with wired glass and good shutters,—a type of construction feasible for warehouse purposes, at least.

Better yet are heavy brick or concrete walls without any openings whatever, nor having any structural members of floors or roofs framed into it. Such walls when carried a suitable distance above the roof are commonly used to subdivide buildings of large area or value.

If by means within the power of modern building methods, consistent barriers to fire are used, not allowing too large areas, the spread of fire can in most cases be controlled.

There are several well known illustrations, such as the fire which burned itself out in a room of the Singer Building filled with office records, without being known until afterward, and a similar fire in a students' room in Harkness Hall, the most recently built Yale dormitory. This latter fire happened during the absence of the occupants over a week-end, who discovered when they returned that the piano and nearby furniture were entirely consumed, although not all the woodwork in the room was burned.

Ex-Chief Croker of the New York fire department built himself a dwelling of fireproof construction, invited a party of friends to dinner and then set a fire in a fully furnished room adjoining, closed the door and let the fire burn itself out while they ate dinner.

We have photographs of the room before and after the fire and the structural damage was so slight, even though every trace of combustible material was destroyed, that one of our engineers looking for illustrations of damage by fire to fireproof construction refused to use the picture, saying it didn't look bad enough.

These illustrations show the effectiveness of the principle, though it is obviously impracticable in most cases to carry subdivision to that extent.

Notwithstanding Chief Croker's case, we cannot afford to trust fires to burn themselves out, so even though we do all we can to prevent them and to limit them, we must provide for extinguishing them.

From the simple fire pail up to the motor fire engine every device has been tested and reported by insurance engineers till its defects are remedied.

From tanks to the largest gravity reservoir systems the water supplies are examined and tested. It isn't always easy to persuade a man that a pressure of 150 lbs. may become quite inadequate for his needs, but if a test under service conditions pulls it down to 25 lbs. right before his eyes, he is convinced. Thousands of such tests are made every year.

Fire pumps are tested spring and fall with actual capacity tests. Sometimes tests are made in the middle of the night to see if the mill is living up to the maxim, "Never let the steam pressure get below 50 lbs. nights or Sundays"; 50 lbs. at 2 A. M. in the summer time doesn't necessarily mean much, and I have seen gauges make left-handed steam rapidly when a thousand-gallon pump was started at full capacity, in spite of the most frantic stoking of the mass of clinkers under the boilers.

Fire engines are tested for acceptance and not long ago a bad fire occurred one night in a Connecticut town when a couple of the insurance experts on fire department apparatus happened to be in the hotel. They went out and found the department badly handicapped for water but discovered standing idle two blocks away a new motor fire engine. The chief told them the only man in the department who could run it was away, so these fire insurance engineers brought it round, ran it all night and put the fire out.

As a result of the work in all these directions we have been

describing there has been formed a literature containing information of great value. Records of tests of devices and materials, the behaviour of different types of construction in actual fires, practical results of field experience, all are available if one knows where to look.

The practicing engineer can use them to advantage to his own profit and that of his client by calling on the insurance companies that keep these references.

So much for the relation of engineering to fire insurance, looking at it from the viewpoint of what those in fire insurance employment have accomplished.

Now let us look at it from your side, the relation between fire insurance and the work of the engineer in professional practice.

To economy of operation, relative cost of construction, lighting, heating, he has been keenly alert, but he has not always been so quick to recognize conditions threatening the destruction by fire of a plant in every other design of which he took so much painstaking care. Tell me why any engineer, even for the sake of convenience, should put into the top of a magnificent factory hundreds of gallons of naphtha mixture piped to tanks spread all over an important floor area!

A high moral reason why the engineer should be interested is the conservation of life and of value against loss by fire. Every fire may threaten life. Some fires have taken fearful toll:—574 in the Iroquois theatre, 150 in the Triangle Shirt Waist Company, 175 in the Collingwood school. Every structure within which people gather has serious possibilities.

The loss which the per capita fire tax represents may be visualized by considering Hartford's share as $500,000 annually.

But there is a direct and more material appeal in the saving in the cost of insurance which may be made by giving full consideration to the significance of fire insurance engineering problems. This saving is as vital to your client as any other. It applies not merely to the value of the building but also to that of the contents, and it continues year after year, as long as the property exists. A mistake in judgment of the efficiency of a machine may be remedied in a little while, for machines wear out or become obsolete, but the penalty of overlooking an insurance saving is a permanent tax.

You know that the cost of insurance depends upon the premium rate and that the rate varies according to the nature of the risk, being made up, generally speaking, by making charges for defects and allowing deductions for the good points. The presence of charges furnishes a strong incentive to the property owner to remedy the defects in order to remove the charges and reduce his rate.

Now, if no special consideration is given to these things in the design and arrangement of a plant, there are almost certain to be charges included in the rate which could have been made unnecessary.

As an example of this, let us consider a woolen mill with the picker in the main plant and there was a charge of 50c for the picker hazard. If the plant was worth $100,000, the presence of that one hazard would cost the owner $500 a year in premium. Suppose, however, that in designing the plant it had been arranged to put the picker in an addition so securely cut off from all other buildings that a fire there could not spread, and assume the value there to be only $10,000. Then the picker charger would apply only to the $10,000 and the premium due to the picker hazard would be only $50, a saving of $450 a year over the other condition.

To illustrate the principle in another way, suppose in the rate on this risk there was a charge of 15c for absence of fire pails; then this would cost $150 annually in premium. If fire pails cost $5.50 a dozen and six dozen would fill the need, at a cost of $33 on the basis of a life of four years for a pail, an outlay of $33 would make a total saving of $635, figuring simple interest at 5%.

You see how such considerations might have a decided influence on the ultimate economy of a design.

The question is, how shall we get before the men in the engineering professions the importance and significance of the fire waste and create in their minds a sense of interest in and personal responsibility for a decrease in it?

So far as future engineers are concerned, this could be done by giving all the students in an engineering school a series of carefully chosen lectures by the very best obtainable men in the insurance profession. These students would then carry into administrative positions a knowledge which would make them take

measures of their own to prevent fires and quick to coöperate with the insurance companies to that end.

For those engineers already in practice, membership in the National Fire Protection Association would help through its publications; and a recognition by them in the programs of their meetings of fire insurance topics, would also help.

In conclusion, let me emphasize the fact that the fire insurance profession has a large amount of data of value to engineers, and that the companies welcome their coöperation to lessen the fire waste and reduce the fire tax, and will be glad to help them.

SOME POINTS IN PUBLIC UTILITY VALUATION*

By Charles Rufus Harte, Member Connecticut Society of Civil Engineers, Construction Engineer, The Connecticut Company.

Although it might well be supposed that the valuation of Public Utility property was a comparatively simple matter, this is by no means the case. In the first place, there are a good many practical difficulties connected with the making of the necessary inventory of the physical elements; in the second place there are important and honest differences of opinion among sound thinkers as to some of the fundamental principles; and lastly, but by no means least, there are unfortunately loose many "economic maniacs," as a notable engineer has aptly called them, whose dangerously unsound doctrines of valuation and the closely related subject of rates have just enough truth in them to mislead and confuse those who do not carefully analyze them.

Since this is so, it may be well to touch upon a few important points of the subject, and that there may be no misunderstanding from different opinions as to the meaning of certain words and expressions, we will start from the beginning.

Business requires money for two quite distinct purposes. There must be funds with which to purchase the necessary plant, and from time to time the additions required; and there must also be funds with which to meet the expenses of producing what is to be sold. Money for the first, the capital expense, is secured from those who either by direct contribution become part owners as partners or stockholders, or by loans become holders of bonds, which are simply parts of a mortgage or mortgages; money for the second, the operating expense, is secured from the sale of the product. And under modern business procedure, no capital expenditure may be made directly from earnings, nor may operating expenditures be made from capital.

The investor is led to put his money into a business either because of the certainty or because of the amount of the return he hopes to receive; the business that is well established, or that

* Presented at the meeting of February 20, 1923.

promises well, has little difficulty in securing all the money it needs, and that at low rates of interest; as the prospects become less attractive, it becomes more and more difficult to secure necessary capital, even at high rates of interest. This is the very A B C of modern business, and it would seem too obvious to mention if it was not for the fact that quite a few persons, at least some of whom certainly ought to know better, in dealing with the subject of public utility business entirely disregard these most essential facts.

A public utility, as the expression is generally understood, differs from other forms of business activity in that, supplying an essential public need which cannot be met by a series of small independent units, but requires an extensive and costly plant, it must meet certain obligations to the public, and in turn, is entitled to certain privileges and protection from the public, that do not apply to other kinds of business. The public demands continuous and adequate service at reasonable rates; in return it grants to the public utility special privileges as to the use of public property; it often delegates to the utility the right to condemn property for public use; and in theory at least, it permits no direct competition.

In all other respects but one the public utility business and the private business are alike; each from time to time requires new capital for additions and extensions, and each attracts such capital to the extent that the return offered is dependable and adequate to the risk taken. But while the private business is free to change the price of its product the instant expenses increase,—and for that matter even before such change,—and while it can maintain as high a price "as the traffic will bear" until a change in general business conditions necessitates a revision, the public utility, at least in most states, must clearly prove that its operating costs do not leave out of its earnings a fair return to the stockholders before it can make any increase in rates, while it is liable at any time to be ordered to lower its rates. The funds available for returns are therefore not only affected by the normal ups and downs of business in general, but they are liable to further disturbance by rate regulation, and this added uncertainty, other things being equal, tends to make public utility securities a little less attractive than those of businesses not subject to regulation. It is therefore essential, if the public utility is to be at all successful in securing necessary capital for extensions, that regulation of

rates shall neither discourage business by making them too high, nor retard growth through unattractive returns due to rates too low. It was doubtless these or similar considerations which led the courts to set up the theory of valuation to fix the limit below which rates became unreasonably low, leaving the question of what were too high rates to the regulatory bodies.

The first rate regulations were the result of unfair practices by many of the railroads, and for the most part they were as unfair as the practices which had led to them. As you all know, the Constitution provides that property may not be taken against the owner's will except for public use, and then only by due process of law, and for fair compensation. The railroads claimed that this rate making was an unconstitutional taking of property, but although there were cases in the Supreme Court from 1874 to 1894 it was not until the latter date that the famous case of Smythe versus Ames settled that question.

In that case Justice Harlan, speaking for the Court, said:

> "We hold, however, that the basis of all calculations as to the reasonableness of rate to be charged by a corporation maintaining a highway under legislative sanction must be the fair value of the property being used by it for the convenience of the public. And in order to ascertain that value, the original cost of construction, the amount expended in permanent improvements, the amount and market value of its bonds and stock, the present as compared with the original cost of construction, the probable earning capacity of the property under particular rates prescribed by statute, and the sum required to meet operating expenses, are all matters for consideration, and are to be given such weight as may be just and right in each case. We do not say that there may not be other matters to be regarded in estimating the value of the property. What the company is entitled to ask is a fair return upon the value of that which it employs for the public convenience."

While this decision, which has had numerous approvals by the Supreme Court since that time, started "valuation," not only did it fail to tell what constituted value, but so far as I know there never has been an authoritative decision in this matter, and what Justice Harlan said were elements to be considered was so indefinite that it would not have helped a great deal even if it had been a part of the decision; it was, however, "obiter dicta," "thoughts by the way," which a judge is privileged to express, but which, referring to matters not specifically covered by the testimony, have no real legal force.

What, then, is this value which is to be found? Value is the worth of a thing; it is the sum which at the general rate of interest would produce the same amount as the return from the thing; it is what the man owning it, and willing to sell it, but not obliged to, would take for it, and what the man wanting it and willing to buy it, but not obliged to, would give for it.

At least this is the case in business other than that of a public utility.

Unfortunately in the case of a public utility, this simply takes us around in a circle; the value fixes the rates, the rates fix the return, and the return fixes the value. To avoid this there have grown up two groups, one basing value on investment, the other upon the cost of reproduction.

The investment is what has actually been put into the capital account, and if it resulted from fair sale it was, at the time of the sale, the value. At any other time, however it may or may not be the same. Other things being equal, the difference between cost and value at any time will be in the same relation as the general average of prices at the time of purchase to the general average of prices at the time in question. The value however depends upon more than just the prices of the labor and material involved. The public may or may not buy freely of the product for various reasons, or developments in it or in other related lines may indicate difficulties not yet actually occurring. Still further, the investment may have been at anything but a fair sale; it may have occurred at a time of abnormal prices. Altogether, if it were not for the practical difficulties of finding the cost of reproduction, there would be little to commend the investment basis, and while some of the Commissions have accepted it, the Courts, and particularly the United States Supreme Court, have been quite unanimous in holding that the cost is to be the measure only when it is the same as the value at the time of the inquiry.

Moreover, while at first thought it seems very easy to find the actual investment, in the case of many of the older utilities this is very difficult and in some cases quite impossible, and an estimated original cost is open to many of the objections to the estimates of the reproduction theory. It has however this strong point in its favor where, on the face of it, the amount seems reasonable. It then presumably represents the best business judgment of the men, who by their courage and confidence established the service, as to

the real value of the undertaking at the time the investment was made, but unfortunately, there are a good many cases where on the face of it the investment does not seem reasonable.

The reproduction cost theory is based on the fact that at any one time the fair price is the fair value. In its most reasonable form it calls for the imaginary reconstruction of the property just as it is, with all the conditions except the presence of the property itself exactly as they are. That is, it supposes that the city or territory had grown up without it, and that now it is to be built.

The principal objection to this method is the hypothetical character of the very foundation. How, in the case of a railroad, for example, it is possible to think of a community which owes its existence and prosperity to the railroad with which it has grown up, suddenly deprived of that railroad without itself changing, has troubled a good many courts and commissions, and Justice Hughes, in the Minnesota Rate Case, denounced this phase of the method in no uncertain terms:

"The assumption of its (the railroad's) non-existence, and at the same time that the values that rest upon it remain unchanged, is impossible and cannot be entertained."

Nevertheless, if the value of the property is to be the measure by which rates shall be tested, it is quite probable that this will be the plan followed, and in a number of cases, after criticizing certain features of the method, the Master or the Court has accepted it in a modified form, because, after all is said, it is upon just such "hypothetical" estimates that the financing and construction of any project is carried out.

Another objection that has been urged, but not so strongly, is the difficulty of selecting proper prices, but this applies with equal force to the investment theory, if, as is usually the case with the older properties, it is necessary to estimate some of the original costs. It may be of interest to note that there have been a great many price bases used in various valuations ranging from actual prices as of a definite date, average prices over an extent of time ranging from one to a number of years,—the Federal Valuation of Railroads uses the average of the years 1910 to 1914 inclusive,—or hypothetical prices, estimated for some date in the future, through consideration of the tendency of prices over a considerable period previously.

In 1887, the "Act to regulate commerce," better known as the Interstate Commerce Act, definitely fixed the railroad question as a Federal one. It was soon realized that some solid foundation must be laid for the work which was coming, and in 1913 an amendment to the original act provided for a Federal valuation of the property of all carriers subject to the provision of the Act itself. The discussion over, but just preceding, the passage of this amendment occurred at a time when many different propositions were being advanced, and evidently with the differences of opinion in mind, and desiring to omit nothing important there was drawn up an amendment which provides that the Interstate Commerce Commission shall report:

"the original cost to date, the cost of reproduction new, the cost of reproduction less depreciation, and an analysis of the methods by which these several costs are obtained, and the reason for their differences, if any."

They are also to find and report:

"other values, and elements of value, if any—and an analysis of the methods of valuation employed, and separately from improvements the original cost of all lands, rights of way and terminals—as of the time of dedication to public use, and the present value of the same, and separately the original and present cost of condemnation and damages or of purchase in excess of such original cost on present values,"

together with various other facts thought to be of importance.

Under this Act about 60 per cent. of the 248,000 miles of road affected have been completed, as the Bureau of Valuation of the Commission considers it; the railroads claim that the findings lack elements required by the Act. The field work on all lines is practically finished and the Acting Director of the Bureau on October 7, 1922 estimated that the land, engineering and accounting reports for most if not all of the roads would be completed and revised by June 30, 1924. As of June 30, 1922, the Bureau of Valuation had spent on this work some 23 millions of dollars and in substantially the same period the carriers had spent approximately 63 millions. Nor do these 86 millions of dollars spent in railroad valuation alone by any means measure the full extent of the work involved. The Act provides that the value found for each road shall be served upon the road when it may protest any or all parts of it, but that after the protests have been heard, and this tentative valuation, corrected or as it was first submitted, has

been accepted and approved by the Commission, it shall thereafter be kept up to date and shall then be prima facie evidence of the value of the property in all proceedings under the Interstate Commerce Act and in all judicial proceedings for the enforcement of that Act, or to enjoin, set aside, annul or suspend in whole or in part any order of the Commission.

The Carriers are by no means satisfied that the results so far obtained either give the true value of the properties, or comply with the Act in regard to the information to be furnished as to the methods followed, the differences, if any, and the analyses to be made, and there will undoubtedly be appeals to the Supreme Court, out of which it is to be hoped that there will come definite rulings and decisions as to what is value, and how it is to be found.

It will be seen therefore that the subject is far from a finished one, for while practically all of the higher court decisions have been along the same general lines, there have been important differences of opinion as to details both of principles and of applications, and until these are reconciled there can be no permanent security in the result. Still further, it is by no means certain that this will give the real answer, for after all, that which the consumer buys is the product, not the plant. As Mr. Matthews, in one of the New York Consolidated Gas Cases, pointed out, so long as the egg is not unduly small or dirty the farmer very properly receives the same price for it whether it was laid by a beautiful young pullet of long pedigree, or by a decrepit old hen of commonest stock, and so long as the light, the heat, the water, or the ride is up to standard, the buyer has no concern in the plant other than that arising from his right to be assured of service so long as he pays proper rates.

That it is difficult to measure the value of the service is not a satisfactory reason for adopting a method by no means necessarily conclusive. If the "cost to reproduce" includes, as it properly should, the value of the service, it is a complete measure of the value on which the return is to be based; otherwise it is not, for a property which, as far as physical elements are concerned, might be reproduced at a much less cost than a very similar property so far as facilities were concerned, but not serving a real need, might well have a far greater value as regarded the service it gave. And if it is possible to measure this value of the service, the logical plan would be to go no further, but base the rates on this.

Eventually there will be found a method for measuring the worth of the service, and it is by no means improbable that this will be by some modification of the procedure, justly discredited when improperly applied, but absolutely sound economics, that of "charging all the traffic will bear," for after all, that is exactly what is done in private business, and the just price for service certainly does lie between the figure so high that it is more advantageous to do without the article, and the price so low that the resulting income is not attractive to capital. The private business need go no further; the public utility, because of its special privileges from the public, must in justice make an allowance for this in the rates.

And this brings out the fact that really underlies the whole question of rate making; it is a matter of exchange, and exchange depends fundamentally on compromise of opposed interests and not upon any exact mathematical laws. When each side approaches the question in a spirit of fair play, a conclusion just to all is not difficult to secure; in the absence of such attitude all the valuations in the world will avail but little.

THE WORK OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS*

By John H. Dunlap, Secretary American Society of Civil Engineers, New York, N. Y.

It is a great pleasure to be with the Connecticut Society of Civil Engineers, now holding its thirty-ninth annual meeting. What a record that is of participation together in those things in which the engineer should be making a contribution to his community! The first duty of an engineer is to that which lies nearest him, including the engineering organization nearest him, if he has the good fortune to find such an organization near him. If this is a local city club, his first duty is there, and his next duty is to his state organization; and then, his final duty in a professional way is to support a national organization; but never should his support of a national organization be at the sacrifice of his support of his local or state organization.

The subject which your President has announced, "The Work of the American Society of Civil Engineers," is perhaps somewhat misleading. I do not want any member of the Connecticut Society of Civil Engineers to feel that the great work which I am going to attempt to describe, is solely the work of the American Society of Civil Engineers. It is rather the work of the civil engineer that I have in mind.

To be sure, the American Society of Civil Engineers is the oldest national engineering society in this country, having been founded in 1852, almost exactly 70 years ago. That date takes us back to the time of Napoleon the Third, Emperor of France. In 1854 Commodore Perry made his second expedition to Japan, and it was not until 1865, eleven years later, that Japan was opened to the world. Durng these 70 years, many important events have taken place. For instance, we have had 12 major wars, to say nothing of the minor conflicts. Moreover, in civil affairs there has been a great advance due to the application of steam, electricity, and gasoline to the generation of power. This has transformed the world into a mass of engineering units, upon the

* Presented at meeting of Feb. 20, 1923.

proper functioning of which the safety, convenience and progress of the world depend. Accompanying this industrial transformation has come the social revolution, with new ideas of poverty and wealth, of government and education, and of society itself taking possession of the popular mind. Strange to say, this transformation of the world into an engineer's world has been so rapid that engineers themselves have been unable to keep pace with it.

For example, not long ago a friend of mind was driving his car about half a mile distant from the Arlington National Cemetery, and suddenly he heard a voice, speaking out of the ethereal blue, in tones loud and distinct enough so that he could hear what was said. He stopped his car, got out, and looked around. No speaker was to be found. Upon due reflection, he decided that the amplifiers in the Memorial Amphitheater were being tried out in preparation for the Memorial Day address of President Harding. We now know that that address was heard not only by a vast throng assembled in and near the Amphitheater, but also by large assemblies in New York and San Francisco.

Last fall Herbert Hoover wished to address the National Electric Light Association at Atlantic City, but was unable to leave Washington. Accordingly his address was delivered over the long distance loud-speaking telephone. Last Wednesday evening, in the Engineering Societies Building in New York, a joint engineering meeting was held between New York and Chicago, with audiences in each city, with pictures illustrating the addresses, which were discussed, first by one audience, then by the other. Two friends living near New York have told me that they had the pleasure of listening to the broadcasting of that event, which was first transmitted by long distance wire from Chicago and then amplified over the audience by loud speakers.

We live in a day of marvels—engineering marvels, and of progress so rapid that we engineers scarcely realize the extent to which we have transformed the world. The truth of this is evident, if you will but in imagination begin an ordinary day's work. Getting out of bed at the early hour to which engineers are accustomed, before daylight, you push a button on the wall, and instantly the room is flooded with light. Think of the long line of researches in applied science which made possible the electric light! Then you dress for breakfast. The clothes which

you don are the product of machinery almost human in its fineness of product and delicacy of adjustment, the work of many types of engineers—mining, mechanical, chemical, industrial engineers, and we should not forget the marine engineer, for doubtless many of the things you wear have been imported from abroad.

You go to breakfast. The grape fruit comes from Florida, the bacon from Chicago, the flour for the toast from Minnesota, the oatmeal from Iowa, the china dishes from France, the silver from Mexico, the linen from Ireland—all brought to your door by vast transportation enterprises composed of engineering units of many types.

After breakfast you go out and start your car. If the engineer had done nothing but develop the internal combustion engine, he might be considered as having performed a great service to humanity;—or, if you will, you take the trolley car into town,—again profiting by the work of many types of engineers. Moreover, the pavements over which you pass should be the work of the engineer from the time the materials composing them are being manufactured until they are finally in place. The streets along which you ride should be part of a comprehensive city plan in which the engineer has had a leading part. The buildings by which you go remind you of the necessity of a building code, in the development of which the engineer should give important service. At the office, during scarcely a moment of the day are you out of touch with some of the conveniences and comforts which the engineer has made possible.

These illustrations might be multiplied many times to show the extent to which the world has been transformed into a mass of engineering units, upon the proper functioning of which depends the future progress of humanity. Naturally, out of this transformation have grown serious problems. Our transportation systems have not been slow to realize this. For years the Pennsylvania Railroad has taken its presidents from men who have risen through the engineering ranks. I was told the other day by E. T. Howson, Western Editor of the Railway Age, that of the mileage of class one railroads in this country, more than 60% is under the operating direction of men who have risen through the engineering ranks to their positions as chairmen of executive boards, presidents, vice-presidents in charge of operation, or general managers. If you read the editorial in the Railway Age for

January 13, 1923, you will find that of the 25 railroad presidents whose salaries were reported to the investigating committee of the Senate as having been in excess of $50,000 per year in 1921, there are ten or eleven who have risen through the engineering ranks, and the highest salary of $100,000 is paid to Julius Kruttschnitt, Chairman of the Southern Pacific, who began as an engineer on construction at the age of 24.

But not only are our railroads coming to realize our dependence upon the engineer; our industries are coming to realize it, also. The largest washing machine factory in the world has as its president an engineering graduate. One of the new vice-presidents of the American Society of Civil Engineers is the President of the Gulf Refining Company and a director in its numerous associated companies. One of the new directors is the General Manager of the Baltimore and Ohio Railroad. Another illustration of the engineer in industry is the managing director of the National Industrial Conference Board, who is bringing to bear upon industrial problems the methods of the engineer, of applied science—methods which survey the facts, analyze them and draw conclusions based upon the analysis.

Not only our industries, but also our cities, are coming to realize their increasing dependence upon the engineer. For instance, the majority of our city managers are engineers, although the engineering profession, as such, has shown remarkably little interest in this development.

Now, with such an environment, with the world increasingly becoming, and to a surprising extent already being, an engineer's world, what an opportunity is given for engineering society work, whether it be national, state, or local. In our own work we are developing a good many new lines of activity. I have already described some of these, at luncheon, to a group of our own members, and do not wish to go into details, at this time. We have our four general meetings, at different places in the country, each year; and in addition eight or ten monthly meetings in New York. We have our publications. During the 50 years in which the Society has been publishing papers, about 1,500 papers have been incorporated in the literature of the profession. We have our committees, and joint committees and boards, composed of men who give generously of their time to this work. Among the reports of these committees which have become classics are those

on Standard Rail Sections, Valuation of Public Utilities, and Uniform Tests of Cement. We have our local sections, scattered all over the country, 39 of them. We have student sections in 53 educational institutions.

In addition to these general features of our work, there are many others I might mention, had I the time.

Let us think for a moment now, about what the future of the engineer's world, and of the societies which serve it, is to be. Is there not in all progress a law of acceleration? If at the present time there is great rapidity of progress in the technical advancement of the profession, is there not going to be acceleration in the present rate of progress? Is not the next decade going to be filled with a truly wonderful development which we at this time can scarcely sense, and in which the engineering societies of this country, as in the past, are to play an important part?

But, in addition to the advancement of the profession, what is to be the attitude of our engineering societies in regard to those problems which are growing out of the new era, which are the result of the transformation of the world into an engineer's world? What sort of service is the engineer going to render in the future, in the solution of the problems, the creation of which he has been to so large a degree the cause?

Let us remind ourselves of some forgotten facts that have a bearing upon what group in the future is going to be of the greatest service to this nation and the world. In 1917 and 1918, 1,730,000 of the officers and men of our national army were rated by intelligence tests. What do you suppose the results were? What was the average intelligence of that group—a group including much of the flower of young manhood of this country? If we knew that, it might shed some light upon some of the problems arising to-day in the body politic.

While these statistics need to be interpreted with great care, yet they illustrate a general truth which is of importance as we face the future. The result of the tests indicated that the percentage of men in our white national army with mental age less than 13 years was 47.3. Apparently, then, a surprisingly large percentage of the best young men in the country have a relatively low degree of intelligence. Further, it was found that 12% in the white draft were superior men, 66% average men, and 22% inferior men. In the negro draft the percentages ran higher—80%

inferior men. Of those born in foreign lands, the average percentage of inferior men was 46. Poland contributed 70% inferior men, Italy 63%, and Russia 60%, meaning nothing with respect to the national characteristics of these countries other than that their representatives in this country at present are young men of a relatively low order of intelligence.

Now, as you weigh these facts, what do they mean? They mean that a large percentage of our population has a comparatively low order of intelligence—has not progressed, probably never will progress, beyond the age of the fairly matured child. They mean that a relatively small percentage of men belong to the superior class, so far as intelligence goes. These facts should make us very thoughtful in regard to a government such as ours, in which every individual has the right of participation in governmental affairs.

Our forefathers were wise enough to create here a representative form of government, believing that on the whole people would follow wise leadership. Now, what are to be the sources of this leadership? We see all sorts of influences at work that are very wisely taking into account for their own purposes, the sort of intelligence presented by the American people. We see, for instance the sort of thing that Hearst is doing in his newspapers. We know what even the best newspapers have to do in order to create a sale. The other day no less a paper than the New York Times had upon its front page in a prominent location, a long description of an individual who had endowed a cat hospital, and in an insignificant place on the inside was a description of a meeting presided over by former Supreme Justice Clark, to discuss ways and means of bringing about a better state of international comity.

Or, consider our moving pictures, to-day. A few weeks ago I was in Ann Arbor, and bought a paper. In a prominent place, occupying half a page, was an advertisement of a movie show, with a picture of a woman lying on a luxurious couch. Beneath that, in big type—"The Loves of Pharaoh"! And the picture was guaranteed in its frankness to shock Ann Arbor. When I got back to the little village of Dobbs Ferry, they brought me a special circular, knowing my interest in that particular film, and put it under the front door, and when I picked it up, there again was the "Loves of Pharaoh." Now, who on earth, in this day and

generation, is interested in the "Loves of Pharaoh," except grown up children?

Take the situation which has developed in the labor union problem. Last September, along with others, I visited Aurora, Illinois, to inspect the Burlington's track elevation work. They were spending five million dollars on seven miles of work. At noon they took us down to some new barracks, recently erected. We had luncheon cooked by a chef paid $25 a day, $750 a month, in a large room where about seven hundred men were fed at one time. Why had those barracks been constructed? Why was this being done inside the company's fences? Because of a strike. Because those men inside of the company fences did not dare to go home nights. Because civil government in Aurora had broken down and was afraid to say that a man has the right to accept employment anywhere and any time he pleases. There you had, right in this republic, practically mutiny against civilization. In view of these facts is it not time to inquire,—Where are we to look for leadership through these troubled seas into fair harbors of liberty, of right and justice? For myself I think we must look for leadership by the relatively few men who have superior ability. And it must be a new sort of leadership. In the past leadership has been principally for the purpose of gaining personal advantage in the way of wealth or political power. In the future, leadership must be for the purpose of securing for each individual the highest degree of usefulness to which his intellectual capacity entitles him.

Where, to-day, is the superior intelligence, required for such leadership, to be found? I would welcome a classification of the professions on some basis of well conducted and wisely arranged psychological tests. Personally I have no fear of how the engineering profession would come out. Do you recall the results of the psychological tests of the engineer officers of our army? Have you seen that chart in Volume 15 of the National Academy of Sciences Memoirs, in which the engineer officers of the army are the only group in Class A? All the other occupations, according to those tests, were of lower intelligence than the engineer officers. Have you seen that companion chart, showing the comparative intelligence of the officers of all the various branches of the service, with the engineer officers overtopping all the others? Where is leadership to come from? Although a survey of the

facts would show that the engineer is to-day making a great contribution to leadership, yet it would also disclose that a great field of future opportunity is open to him.

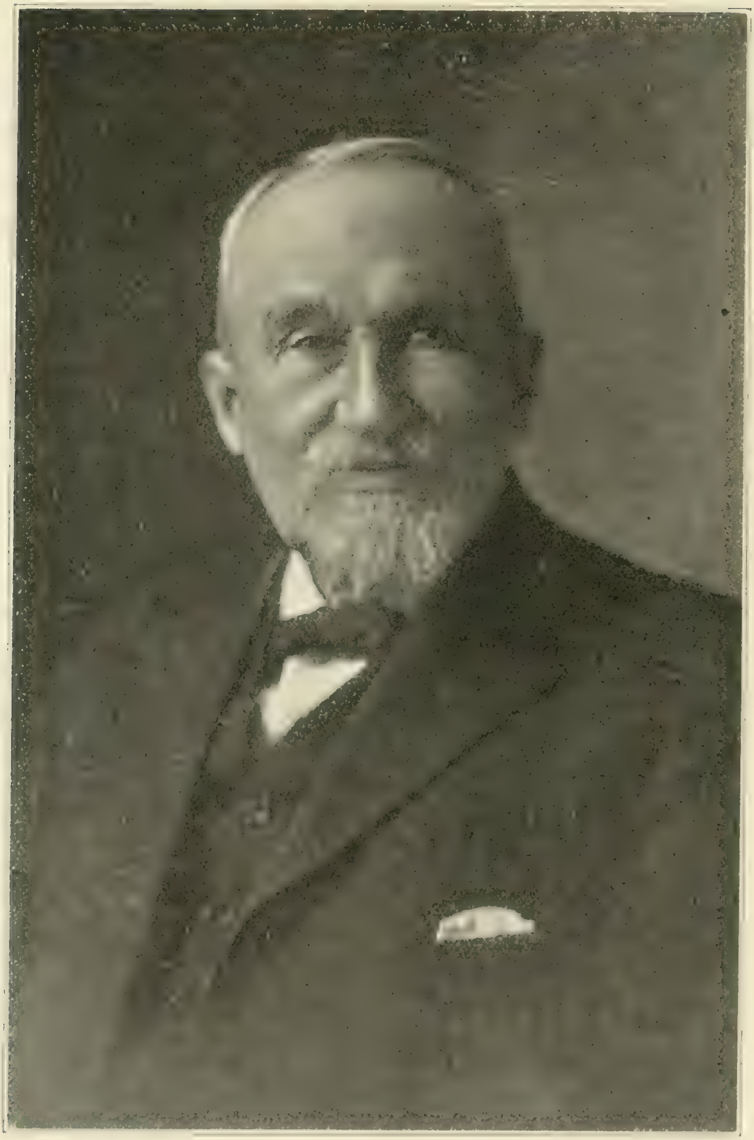
If the engineer to-day is not occupying the position of leadership that he should, what is the formula by which he may occupy that position? Is there any way to assume leadership, except to lead?

How much time are we engineers devoting to the solution of the problem of good citizenship in our community, in our ward? How much time do we devote each week to the solution of community problems right at our doors? Is there any way of solving such community problems, except by a group of men with the training an engineer has, which causes him to take into account the facts, to survey the facts, to make his decisions in accordance with the facts, and to carry those decisions out into actual work.

Now, if this is to be done, we must, within the engineering profession, take a great many advance steps in the immediate future, and one of those steps must be the training for leadership of our engineering students throughout the country. Dean Cooley states that the engineer of to-day is not as well trained for the solution of the problems of his generation as the engineer of a generation ago. The facts are that a generation ago only 14% of the medical schools required for entrance more than one year of high school, as compared with 33% of the law schools and 80% of the engineering schools. In length of course, 91% of the medical schools had a four year course which averaged 28 months in attendance, as compared with 98% of the engineering schools with an average of 35 months. The law school course was much briefer than either of the others. In other words, a generation ago, so far as the time element goes, which while important, is admittedly not the only element in education, the engineering schools were at the top and the medical schools at the bottom with the law schools in a middle position. To-day the relative position is reversed, so far as time goes, in the preparation of a man for his profession; medical schools are at the top, law schools in the middle, and engineering schools at the bottom. And now our leading colleges of dentistry are requiring five years of work. Of course for many years the best theological schools have required a complete college course for entrance. At present,

therefore, the enginering schools are fifth among the professional schools, so far as the time element is concerned.

A tremendous opportunity is ours, in this new era, as engineers, as men on the average of superior intelligence,—a great common work to which not only our national societies must give themselves in increasing measure, but also in which our local and state societies of every sort have an important contribution to make. In the future there must be no tendency within the engineering profession to life in water-tight compartments, with technical performance, jacketed off from interest in enterprises of good citizenship, and from those efforts to strengthen the heart of the world and to increase the spiritual endowment of mankind.



CHARLES H. BUNCE.

CHARLES H. BUNCE.*

Died December 27, 1922.

Mr. Charles H. Bunce, an honorary member of this society, a charter member, also one of our past presidents, and a dean of the profession in Connecticut, died on December 27, 1922, at the home of his son, of pneumonia induced by the infirmities of age. He had passed his eighty-third birthday and up to a short time before his death had been in fair health.

Mr. Bunce, who was born in Hartford, was a descendant of Thomas Bunce who came to Hartford in 1639. He married Mary L. Beebe, the daughter of Mr. and Mrs. Hubbard Beebe of New Haven. Of the six children born, the two that survive him are Mrs. Louisa Bunce Orvis of Paris, France, and Mr. Arthur Merrill Bunce of Hartford.

He was the oldest living graduate of Yale at Hartford at the time of his death, having graduated from the Yale Scientific School in 1862. His first professional work was in the government service at Fort Adams; later he was at Newport. Mr. Bunce was appointed City Surveyor of Hartford in 1872 and held that position, or the later position of City Engineer, except for an occasional year, for thirty years. Many important improvements, such as trunk sewers, improved pavements, bridges, etc., remain as lasting monuments to his engineering skill. For several years, after retiring from the office of City Engineer, he maintained a consulting practice, and was frequently called upon for expert testimony in court cases, and advice in other matters.

The Connecticut Society of Civil Engineers owes much to Mr. Bunce. He served as its fourth president, during the years 1888 and 1889, and probably no other member ever attended more meetings, or took a more active part in all its affairs; and this keen interest was sustained up to a very short time before his death.

His professional work was of the highest and stands for itself; he always maintained the best ethics of the profession and was a

---

* Memoir prepared by Edward W. Bush.

man of the highest integrity of character. A man might have all these qualities and not be the Mr. Bunce that we knew, loved and especially appealed to us. It was the human side of him, the genial good nature and companionship that was always extended to his ever increasing circle of engineering friends, both old and young,—this is what we will miss.

WINTHROP G. BUSHNELL.*

Died Oct. 23, 1921.

Winthrop Grant Bushnell, a son of Cornelius S. Bushnell (who was responsible for the financing and quick construction of Captain John Ericsson's "Monitor" of Civil War Fame), was born at New Haven, March 20, 1864.

He attended the public schools of New Haven, a graduate of Hillhouse High School in 1884. Working his way through Yale College, he was graduated in 1888. He sang during those four years as solo bass at St. Paul's Church, New Haven. He became a member of the editorial staff of the New Haven Journal-Courier, remaining there for a short time only. He then identified himself with the Edison and later with the General Electric interests in southern New England, in the practical applications of electrical machinery for central station light, power and railway service.

In 1905 he bought the control of the New Milford Power Co., improving the property and later surrendering it to purchasers at a substantial profit. He bought the old Falls Village Water Power Co., which was merged with other companies into the Connecticut Power Co., under the guidance of Stone & Webster. Shortly after the Spanish-American War, Mr. Bushnell purchased the lighting and power plant at Camaguey, Cuba, selling it several years later to Canadians.

Mr. Bushnell was an associate member of the Connecticut Society of Civil Engineers, having joined Feb. 14, 1905.

During the World War, Mr. Bushnell was chairman of the State executive committee in 1917 of the Y. M. C. A. War Work campaign; in 1918, chairman of the State executive committee of the United War Work compaign: in both of which campaigns Connecticut responded most generously.

Mr. Bushnell married Harriet E. Schofield, of Cleveland, in 1911, and they were the parents of two daughters. He died very suddenly at New Haven on October 23, 1921.

---

* Memoir prepared by Rev. S. C. Bushnell.

ROBERT C. P. COGGESHALL.*

Died Oct. 20, 1922.

Robert Carter Pitman Coggeshall, the son of Thomas and Caroline (Spooner) Coggeshall, was born in New Bedford, Mass., April 20, 1849.

He received a primary education at a private school, entered the Friends Academy at New Bedford, and later became a student at the Rensselaer Polytechnic at Troy, N. Y.

He gave up the life of a student in 1868 to become a clerk in the New Bedford post office where his father was postmaster. He later accepted a clerkship in East Cambridge.

The engineering instinct was in him, however, and he returned to New Bedford in 1872 to become draftsman, surveyor and general assistant to the superintendent of the Water Department. In 1877 he was elected city surveyor.

Mr. Coggeshall entered upon the office of superintendent of the New Bedford Water Works on June 9, 1881, and continued in that position until April 28, 1922, when he was retired on account of ill health.

Mr. Coggeshall was a charter member and first secretary of the New England Water Works Association.

He was also a member of the American Waterworks Association and the Boston Society of Civil Engineers. Mr. Coggeshall joined the Connecticut Society of Civil Engineers in June, 1887.

He was very much interested in the Masonic fraternity. He was an active member of the First Congregational Society. He was a member of Wamsutta and Brook's Clubs, and served as a trustee of the New Bedford Five Cents Savings Bank.

Mr. Coggeshall married Ledora Jenny on Dec. 21, 1875. She died Dec. 15, 1885. The two children of this marriage, Robert F., an electrical engineer, and Miss Helen R., are both living.

On April 29, 1890, he married Sarah Wall Almy of New Bedford, who also survives him.

Mr. Coggeshall's record of efficiency and service in New Bedford in the administration of the water works has few, if any, equals in any city.

* Memoir prepared by the Secretary.

SOLOMON LE FEVRE DEYO.*

Died August 19th, 1922.

Solomon Le Fevre Deyo, the son of Jonathan Nathaniel and Maria Le Fevre Deyo, was born in Gardner, N. Y., on December 17th, 1850. He entered Union College at Schenectady, N. Y., and was graduated in the Class of 1870.

In 1870-71, Mr. Deyo was Instrumentman on the survey of the Town of Morrisania, N. Y., under the supervision of Gen. George S. Greene. In 1871, he entered the employ of the New York, New Haven and Hartford Railroad Company on the location of the Harlem River Branch, from Harlem River to New Rochelle, N. Y., and, later, was Resident Engineer on the construction of that road. In 1873, he entered the employ of the New York and Harlem Railroad Company, as Resident Engineer on the Fourth Avenue Improvement in New York City. In this position, he had charge of the section from Forty-seventh Street to Seventy-ninth Street, which work included the elimination of grade crossings and the construction of four tracks. He continued on this work until its completion in 1876.

From 1876 to 1881, Mr. Deyo was Superintendent of the American Metaline Company, New York City; from 1881 to 1883, Division Engineer on surveys with the South Pennsylvania Railroad Company; and from 1883 to 1885, Construction Engineer with the same Company. During 1886, he served as Principal Assistant Engineer on the Buffalo and Geneva Railroad, and, later, as Assistant Engineer with the Lehigh Valley Railroad Company.

In 1887, he was engaged in railroad reconnaissance in Northern Alabama for the Pioneer Mining and Manufacturing Company, and, later, in the same year, he was employed by the New York, New Haven and Hartford Railroad Company, as Assistant Engineer in charge of general work. He continued in this capacity until 1890, when he was appointed Assistant Engineer in charge of the Western District of the same road, resigning in March, 1900.

During the latter part of his service with the New York, New

* Memoir prepared by F. S. Curtis.

Haven, and Hartford Railroad Company, Mr. Deyo had supervision more particularly over the construction of additional tracks on the Harlem River Branch and the construction of the terminal yard at Oak Point, East River, including bulkhead, bridges, and approaches for the purpose of transferring cars to and from the boats.

In March, 1900, Mr. Deyo was appointed Chief Engineer of the Rapid Transit Subway Construction Company, New York City, which was organized by Messrs. August Belmont and John B. McDonald (after the latter had been awarded the contract) for the construction of the first underground rapid transit railroad in New York City. As is well known, the problems and difficulties which attended this pioneer line were many, and Mr. Deyo, who personally supervised the writing of the numerous specifications and agreements for the sub-contracts for the several sections of the work, by his tact, ability, and foresight, kept the work up to schedule and frequently acted as harmonizer between the Rapid Transit Commission, with its demands for progress, and the subcontractors who were doing the work. So well did the organization function under his direction that the great work was opened to public use on October 27th, 1904, just four years and seven months after the first official spadeful was turned. On January 10th, 1905, a banquet was tendered Mr. Deyo by his employees and co-workers, at which approximately seventy, including guests, were present, and a large silver punch bowl was presented to him.

Mr. Deyo also held the position of Chief Engineer of the Subway Division of the Interborough Rapid Transit Company (the operating company) until July 1st, 1905. On the organization of the Interborough-Metropolitan Company in 1905, Mr. Deyo was appointed as Chief Engineer and held this position until 1918, when he retired from active work.

He was married on June 24th, 1882, to Harriet Goodrich Brandon, who, with a daughter, Mrs. Royce R. Spring, survives him.

Mr. Deyo was of quiet, reserved disposition, always approachable, having the confidence of all with whom he came in contact, not only those who worked for him, but also those for whom he worked. His fair treatment of all with whom he became acquainted was reflected in the number of his friends. His pro-

gress in life, in connection with his professional ability, was because of his kind and genial manner to everybody with whom he dealt.

He was a member of the Engineers' Club of New York City, which he had joined in 1893, continuing his membership during the remainder of his life. He had also been a member of the Holland Society of New York City since December 29th, 1892.

Mr. Deyo was elected a member of the Connecticut Society of Civil Engineers, January 9, 1900. He was also a member of the American Society of Civil Engineers, having served as a director and vice president in this society.

A. CLARK HALL.*

Died June 23, 1922.

A. Clark Hall, son of William H. Hall and Ellen (Hamilton) Hall, was born October 27, 1877, in West Hartford, Conn. He attended the public schools of West Hartford, graduating from the High School there in 1894. He attended the Connecticut Literary Institute one year and then entered Trinity College in the Fall of 1895.

He left Trinity at the end of his Junior year to accept a position as assistant engineer on the Hartford Water Works, where he was early engaged in the work of surveying and mapping the entire distribution system. Later he became Division Engineer in charge of the Distribution Division, which position he most ably held until he gave up engineering in order to carry out a desire that had been many years in developing.

During his early years with the Water Board the lure of country life, which he had fostered from early youth, grew strong within him and he resolved that some day he would leave the engineering field and take up farming. He spent much of his leisure time in searching for a place that would suit him. At last, finding the right place in Bloomfield, he moved there in April, 1909.

He started farming on a small scale, but continued working for the Water Board—making the trip between Bloomfield and Hartford each day—doing his farm work in the early morning hours, and nights after getting home from Hartford. It meant long days and hard work, but he was building for the future and he enjoyed it. He was dreaming of the day when he could give up his engineering life and devote all of the time to his farm.

In the Spring of 1914 he resigned his position with the Water Board, at last feeling free to think of nothing but his little farm, and laying many plans to develop at his leisure. But the engineering knowledge which he had stored up during the

* Memoir prepared by George W. Penfield

previous busy years was not destined to be laid aside and forgotten. He had hardly severed his connection with the Water Board before his neighbors began to besiege him with requests to survey their farms, to stake out their lots, to lay their drains, make maps, or other similar work.

He did not wish to get back into engineering work again, but he could not refuse to do a favor for a friend or neighbor, and it was not long before he was spending more time behind the transit than behind the plow. After a few years of this, he found it more and more difficult to resist the calls, but he also realized more and more the possibilities of building up a good engineering practice. Finally, but not without reluctance, he gave up his dreams of being a farmer, and bent all his energies towards the engineering field. His work grew and broadened in scope and his field of operations extended from its beginning in Bloomfield to many of the surrounding communities and towns, and to distant points across the state and up into Massachusetts.

Busy as he was, however, with his engineering work, yet he found time to take an active and intelligent interest in the affairs and development of his adopted home town. He served as Chairman of the Town School Committee, Member of the Board of Finance and Member of the Town Plan Commission. As Chairman of the School Committee, he was instrumental in securing the organization of the Hgh School on a full four-year course of study. For that service he won the gratitude of the scholars, who expressed their appreciation in a fitting testimonial.

"TO

MR. A. CLARK HALL.*

"In dedicating this, our first effort, to you, we take this opportunity of expressing our sincere gratitude and deep appreciation for what you have done for Bloomfield High School.

When the School was struggling for its existence, and when the chances for success were small; it was your faith in us and your vision of what we might do that inspired the development of our school. We esteem you as a loyal and true friend. We

*Copied from the first Bloomfield High School Year Book. Published in June, 1922.

shall strive to merit your faith in us. May our future justify the high hopes and ideals you have given us."

He was interrupted in the midst of a busy and useful life by an illness which was to prove fatal. It was a long struggle and a hard one, but he was "on the job" every day as long as he was able to stand, and directed the work of others when his own strength failed. The unbounded courage and optimism that he had always shown lasted through his illness and sustained him to the end.

Besides his parents and sister, he leaves his wife (formerly Olive F. Tyrell) and a son.

While with the Water Board he won the warm friendship and high esteem of all his associates who gave him a worthy testimonial of their regard at the time of his leaving.

He had an exceedingly genial and happy disposition, and was always ready with a smile and a friendly word. With a keen sense of humor and ready wit, he was delightful as a companion and made many warm friends. Because of his absolute integrity and unvarying kindliness, he won the trust of all those he served. He had a remarkable memory, keen reasoning powers and accurate judgment.

He leaves behind him a record of active accomplishment and of fidelity and loyalty to the interests that he served, and to his friends.

FRANK E. HINE.*

Died November 25, 1922.

Frank E. Hine, a member of the Connecticut Society of Civil Engineers, died at the Lawrence and Memorial Hospital in New London, following an operation, in the fifty-fourth year of his age.

Mr. Hine graduated from the Yale Scientific School, Civil Engineering Course, in 1893, and then went to work for the Winchester Repeating Arms Company. Later he had a position with Schofield & Ford, Civil Engineers in Bridgeport, Connecticut. He then went into business for himself for several years, after which he accepted a position with the United States Government, War Department, and spent some years in connection with the early fortification work at the entrance of Long Island Sound. He was first situated at Gardiner's Island and afterwards at the Fort Wright fortifications at Fisher's Island, New York.

It was while there that he was engaged by the Ferguson Brothers to take charge of their Fisher's Island interests, where he spent the remainder of his life.

During the time of his service there he was instrumental in the development of the Island, which included building roads, laying out and installing a water works system, the construction of new streets, superintending the construction of buildings and plants, the building of docks, and recently was instrumental in having the Island connected by cable for furnishing electricity for the lighting of the streets and homes and for the government use. In addition he had the general management of the Fisher's Island Farms Company and the Fisher's Island Navigation Company.

Mr. Hine leaves a widow and four children, Donald F. Hine, graduate of Yale Scientific School, Electrical Engineering, 1921, who has succeeded his father at Fisher's Island, and the Misses Eleanor C., Winnifred C. and Esther J. Hine.

---

* Memoir prepared by V. B. Clarke.

*CHARLES MAPLES JARVIS.

Died May 21, 1921.

Charles Maples Jarvis was born in Deposit, Delaware Co., N. Y., on April 16, 1856.

He took the Engineering Course in the Sheffield Scientific School of Yale University, graduating from there in 1877.

About the year 1880 he became associated with Capt. William O. Douglass in the Corrugated Metal Co., at East Berlin, Conn. When this Company was merged into the Berlin Iron Bridge Co., in 1883, he became its Vice-President and Engineer.

At the death of the President of the Company, Mr. Samuel C. Wilcox, Mr. Jarvis was chosen President and held this position until the formation of the American Bridge Co., in 1899, when the Berlin Iron Bridge Co. passed out of existence.

As President of the Berlin Iron Bridge Co., he was well known throughout the State, and in fact in all New England, as a "Builder of Bridges."

The Parabolic Truss Bridge still spans many streams and is a constant reminder of the Connecticut concern which built them and of its President.

Mr. Jarvis was elected a Vice-President of the American Bridge Co., but held this position but a short time, soon turning his attention to other industries.

He was a charter member of the Connecticut Society of Civil Engineers, joining in April, 1884. He served as President in 1886 and was made honorary member, by vote of the Society, on February 18, 1919.

He was elected a member of the American Society of Civil Engineers on January 7, 1885, but resigned his membership on December 31, 1914.

He became a member of the American Society of Mechanical Engineers in 1890 and served as Vice-President of that Society from 1897 to 1899 but resigned his membership on January 14, 1921.

---

* Memoir prepared by Charles F. Chase.

*WILLIAM HARLEY MOORE.

William Harley Moore, late Engineer of Structures for the New York, New Haven & Hartford Railroad and the Central New England Railway, and officially or unofficially Consultant Bridge Engineer for practically all the subsidiary companies, died September 5, 1920, in New Haven, Connecticut, just one week before his sixtieth birthday.

Mr. Moore was born September 12, 1860, at Limerick, Ireland. He received his technical education at Queens University and at the Royal University of Ireland, Dublin, graduating from the latter institution in 1884. He almost immediately came to America, where for a short time he was employed as a draftsman in the bridge engineering department of the New York Central and Hudson River Railroad, but in May, 1886, he entered the service of the New Haven system, in which he continued until his death, receiving the title of Bridge Engineer in June 1890, and that of Engineer of Structures in May, 1913.

Practically all the important bridges of the New Haven System were rebuilt or strengthened under his direction; indeed a statement of the bridges designed and built or strengthened under Mr. Moore's direction would be an almost complete bridge list for the New Haven Road and its subsidiaries, both steam and electric. Among the most important river bridges may be named those crossing the Mianus at Cos Cob, the Saugatuck at Westport, the Norwalk at Norwalk, the Poquonnock at Bridgeport, and the Housatonic at Devon, all four track bridges; the Housatonic at Derby, at Sandy Hook, and at New Milford, the Connecticut at Lyme, at Middletown, at Hartford and at Warehouse Point, the Niantic at Niantic, Shaw Cove, Winthrop Cove, and the Thames at New London, and Mystic and Noank drawbridges, all in Connecticut; the six track lift bridge over Fort Point Channel, Boston, the Cape Cod Channel lift bridge at Buzzards Bay, and the Seekonk River draw in Massachusetts, and the six track Pelham Bay draw in New York. He also prepared the general plans for

* Memoir prepared by C. A. Sibley.

WILLIAM H. MOORE.

strengthening the great bridge of the Central New England Railway over the Hudson River at Poughkeepsie, New York, which plans were carried out in 1917 and 1918. Of but little less importance are the many highway and city street structures, a considerable proportion of which were built in connection with grade crossing elimination. In some instances a relocation of the line or the character of the highways affected permitted the work to proceed without interference; in many cases, however, notably at the big river bridges, and in the improvement work in Bridgeport, New Haven and Boston, it was necessary to maintain heavy railroad and city highway traffic at the points of construction, and while the general design of the often very extensive and complicated temporary structures needed to permit of this, was the field of the engineer in direct charge of the work, the plans were always checked by Mr. Moore, who frequently suggested some original and most helpful modification.

Mr. Moore was a member of the American Society of Civil Engineers, and of its Connecticut Section; of the American Society for Testing Materials; of the American Railway Engineering Association; of the American Railway Bridge and Building Association, and of the Connecticut Society of Civil Engineers. He did not care for office in any of these, although each one gladly would have so honored him, but he did most valuable work on the several highly important committees of which he was a member.

Mr. Moore was a man of slight physique, but he possessed an indomitable will, and he had so often recovered apparently by sheer will power from serious bronchial attacks, to which for some years he had been subject, that his death came as a great shock to all his friends, although they knew he was a very sick man. He was unmarried, but was survived by his mother and a sister, both living in Brookline, Massachusetts, and several nephews and nieces.

The great technical ability possessed by Mr. Moore was recognized by all who knew him professionally, and his loss will be severely felt in his various fields of professional activity. In his personal life he was a lover of music and literature, being a great reader. His character was of the highest, his personality quietly dignified. He possessed an unusually high sense of honor, yet

was broad in his sympathies, had a great sense of humor, and, as one of his close friends expressed it, was in every sense a real man. Another friend emphasizes "the very genuine and lasting interest which he took in the men who worked under him or as his more intimate associates," and notes that "it always seemed to give him particular satisfaction to aid in the promotion or advancement of men who had won his confidence."

JOHN P. MURPHY.*

John P. Murphy died February 22, 1923, in Hartford, Conn., the city in which he had always lived, at the age of 57 years. He had been a member of the Connecticut Society of Civil Engineers since 1890.

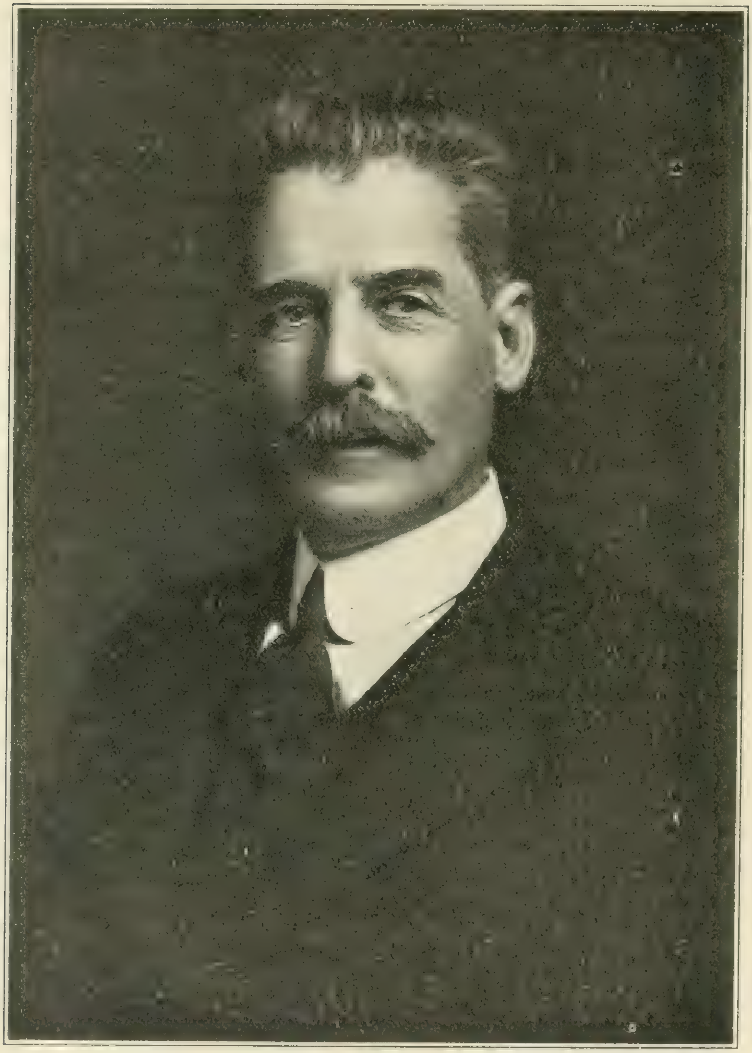
Mr. Murphy was a self-made engineer, never having had special education to fit him for the work of which he had made a success, due undoubtedly to his practical good sense rather than to a fund of engineering knowledge. He entered the employ of the City of Hartford in May, 1887, and had worked from that date continuously until his death.

Mr. Murphy was of a sunny disposition and enjoyed his work and others found pleasure in working with him. He saw the Department of Engineering of the City of Hartford grow from the time when the entire force consisted of the City Engineer and himself to its present day proportions.

Few men in Hartford excelled Mr. Murphy in judgment relative to real estate matters, and as a side line hobby he dealt in real estate, having at the time of his death acquired many very valuable properties. His success and accumulated riches did not affect his modest, unassuming manner, and he was well liked by all his associates. He was seldom absent from the outings of this Society and will be missed not only there, but in the office and in the city where he was so well and so favorably known.

Mr. Murphy is survived by his wife, two daughters and three sons.

* Memoir prepared by R. J. Ross.



LEONI W. ROBINSON.

LEONI W. ROBINSON.*

Member of Connecticut Society of Civil Engineers.

Leoni W. Robinson, of New Haven, Connecticut, died at his home February 12, 1923, after a brief illness. Mr. Robinson was in his seventy-second year. His death removed from this community one of its best and most respected citizens.

He was born at Janesville, Wisconsin, and came to New Haven when very young.

At the age of twenty-four he entered the office of Mr. Hatfield, a prominent New York architect. Later, upon the application of the Supervising Architect's Office, at Washington, for a man to do some special engineering work in computing the stresses in the trusses of the old Grand Central Railroad Station, New York, Mr. Hatfield recommended Mr. Robinson for the position. Mr. Robinson, who was appointed, did the work for which he received high commendation.

A little later, he resigned from the Supervising Architect's Office, for a year of travel and study abroad. Mr. Robinson's resignation from so desirable a position occasioned much surprise among his acquaintances. But he was young, ambitious and far-sighted. He wished to obtain the best equipment possible for his chosen profession. He traveled chiefly on foot, thereby saving money and gaining opportunities for study and observation often missed by the usual tourist.

Upon his return, Mr. Robinson received many flattering offers, but decided to establish an office of his own, which was a success and of great value to his city and state.

He was the architect of many important buildings, among them the First National Bank Building, in which he had his offices, the New Haven Water Company building, the Western Union Telegraph building. He designed many of the public school buildings of New Haven, most of the Winchester buildings and several of the Sargent & Company buildings.

Mr. Robinson served his state with distinction on the Commission for the building of the beautiful State Library Building at

* Memoir prepared by A. B. Hill, Past-President, Conn. Soc. C. E.

Hartford. He was Consulting Architect on improving the State Capitol building.

He was the architect of the state commission directed to prepare plans for a new State Prison. In that connection he made a very thorough study of prison needs and presented a plan of development that was a notable advance in the designing of such structures.

Mr. Robinson was one of the first members of the American Institute of Architects. He was one of the founders of the New Haven Architectural Club and served as its first President. He was regarded as the Dean of the Architectural Profession in New Haven.

Mr. Robinson took an active interest in civil matters. He was a member of the New Haven Chamber of Commerce and of the New Haven Colony Historical Society. He took the leading part in the drafting and formulating of the New Haven Building Code.

Mr. Robinson was a man of clear, sound judgment and of uncompromising integrity. His sterling worth inspired his clients with confidence in him. They knew that his counsel was thoroughly reliable.

He was very modest and unassuming but stood steadfastly for his principles. His family life was most devoted and beautiful.

REPORT OF PROCEEDINGS

OF THE

THIRTY-NINTH ANNUAL MEETING

OF THE

Connecticut Society of Civil Engineers

Incorporated

The thirty-ninth annual convention of the Connecticut Society of Civil Engineers, Inc., was called to order at 10:15 A. M., on Tuesday, Feb. 20, 1923, at the assembly hall of the Hartford Electric Light Company, Hartford, Connecticut; President R. J. Ross in the chair.

THE PRESIDENT: We are opening the 39th Annual Meeting of The Connecticut Society of Civil Engineers. First on the program is the report of the Board of Direction.

REPORT OF BOARD OF DIRECTION.

The first meeting of the Board of Direction in 1922 was held in Hartford, at the City Club, where the members were entertained at luncheon by President Ross. Preparations were started for the summer outing. The selection of the place for the meeting and further details were left to the President and Mr. E. Irvine Rudd. The next meeting was held at Hotel Green, Danbury, where we were in attendance at a meeting of the Society. Only a few members of the Board were present, but an outline of the annual meeting was decided upon. The third and last meeting was at the University Club, Hartford. The President gave us a luncheon. The work of the meeting was the counting of the ballots for nominations of officers, and making final preparations for the annual meeting. There was nearly full attendance at the first and third meeting.

H. J. KELLOGG, *Secretary.*

Report accepted.

THE PRESIDENT: Next is the report of the Auditing Committee.

MR. F. L. FORD. We have no written report, but last Saturday Mr. Harold Blakeslee and I went over the accounts of the Secretary-Treasurer, for the past two years. We find that the Society is indebted to the Secretary-Treasurer for 1921, $98.92, and for the year 1922, $85.25, making a total of $184.17. As to investment in bonds and securities, by the Society, and notes, I think Mr. Kellogg's report as Treasurer will show that.

Report accepted.

THE PRESIDENT: The next business is the report of the treasurer.

REPORT OF TREASURER

RECEIPTS

Cash on hand Feb., 1922	$ 107.83
Received from sale of dinner tickets	305.75
" " 1919 dues	15.00
" " 1920 "	40.00
" " 1921 "	132.00
" " 1922 "	1,056.00
" " 1923 "	4.00
" " donations	5.00
" " coupons on bonds	20.00
	$1,685.58

DISBURSEMENTS

By return of fee	$ 4.00
" stenography	75.20
" music	25.00
" [illegible]	216.08
" dinners, guests and [illegible]	501.50
" express and freight	10.79
" prizes at summer meeting	14.05
" salary Secretary and Treasurer	300.00
" flowers	8.00
" printing (New Haven Printing Co.)	154.81
" " (Tuttle, Morehouse & Taylor)	100.05
" rent P. O. box	6.00
" " safe deposit box	5.00
" baseballs and tennis balls	7.45
" traveling expenses	10.28
" telephone and telegraph	4.06
" postage and stationery	66.33
Balance in bank Feb. 1, 1923	270.17
	$1,770.83

Disbursements	$1,770.83
Receipts	1,685.58
Due Treasurer (as per audit)	$ 85.25

ASSETS FEBRUARY, 1923

First Liberty loan 3½% bond	$100.00	
Third Liberty loan 4¼% bond	200.00	
Fourth Liberty loan 4¼% bond	100.00	
		$400.00
Cash in bank		270.17
		$670.17

LIABILITIES.

Printing 1921-1922 year book (estimated)	$1,435.00	
Printing ballots and notices	27.75	
*Note to Union & New Haven Trust Co.	150.00	
Due Treasurer 1922 (as per audit)	85.25	
†Due Treasurer 1921 (as per audit)	98.92	
		$1,796.92

MR. FORD: In regard to one feature of the Auditor's report. Mr. Kellogg gave his personal note to The Tuttle, Morehouse & Taylor Co. for printing the report, to the amount of $75, and I think he suggested that it should be taken up by the Society when it comes due. That is an obligation I think the Society should take care of, before the note becomes due. One feature of the Treasurer's report is the investment of the Society in Liberty Bonds; originally I think we bought $500 worth of those bonds, and part of them were sold.

MR. KELLOGG: The Victory bond of $100 had to be redeemed, so I let the bank deduct it from the note which originally was $250. That leaves us now with $400 worth of bonds on hand.

It was voted to accept the report of the Treasurer.

THE PRESIDENT: We will now have the report of the Secretary.

REPORT OF THE SECRETARY.

The attendance at meetings in 1922, not including the Annual Meeting, was from 25 to 220. Six meetings were held: Bridgeport, New Britain, Middletown, Storrs, Danbury and New Haven. At Bridgeport we visited the sewage purification works that are under the management of City Engineer McElroy. As he has contributed a paper on that plant nothing need be said of it in this report. At the Stratfield Hotel, where we dined, W. H. Dunham, Jr., gave us an illustrated talk on the trolley and street work in Detroit done under his supervision. It was a very thorough and interesting description and the illustrations were many. At New Britain we were taken to the Donnelly brick yard where we saw brick made under modern methods. The party then went to the works of the Berlin Construction Company, at Berlin. It was the first time some of the party of engineers saw how beams and girders are constructed. This was the most interesting plant, speaking from a strictly engineering view, our members as a body ever visited. At the dinner, that evening, at the Y. M. C. A., Charles E. Price gave us an interesting description, illustrated, of concrete road constructon. That dinner marked the last time that Mr. Charles H. Bunce, charter member and

*This note was originally for $250, but one $100 Victory Loan Bond was redeemed and applied to the note.

†This amount includes a personal note for $75.00 given by H. J. Kellogg, Treasurer, to The Tuttle, Morehouse & Taylor Co., and due Mar. 18, 1923.

ex-president, met with us. He died not many weeks later of pneumonia. He gave reminiscences of his life as an engineer, how in his early years he knew hardly more than six engineers in the State. That was before our Society was organized. Another old timer, John P. Murphy, of the staff of the City Engineer of Hartford, spoke interestingly of early days. At Middletown we visited a concrete brick plant and, later, at the room of the Chamber of Commerce, we listened to a paper by George A. Wilson on the manufacture of concrete brick. We also, that day, visited the factory where the noiseless typewriting machines are made. It was the first time many of us—most of us—had ever seen a noiseless machine. The Middletown meeting had the smallest attendance of any we ever held, twenty-five or less were present. At Danbury we had a fair turnout and made the making of felt hats our study outside of engineering, but we all wear hats. At Hotel Green, that evening, Mr. E. Irvine Rudd gave us an illustrated talk on trolley signals, that was especially interesting. We wound up the year by meeting, in New Haven, at the room of the Chamber of Commerce, where Mr. Albert L. Donnelly gave us an illustrated talk on his recent European trip during which he had picked up much information and many pictures showing trolley and bus transportation. The big time of the year was at the Connecticut Agricultural College at Storrs. A pretty good ball game was played and I shall have to ask which won, Hartford or New Haven. A lot of field sports were engaged in with prizes for the winners. Roger Parkhurst handed out the prizes and joined with Rudd in running off the events. Two hundred and twenty sat at tables and enjoyed a chicken dinner on college-bred chickens. The members had a fine chance to look over the live stock—prize stock—of college raising. The attendance ranks among the big summer events we have had; and that is remarkable as Storrs is the most out-of-the-way location for a summer outing we have ever selected. Further details of meetings will be given by Mr. Rudd who has put in two successful years in arranging for meetings including the annual meetings. It is hoped that the Society will fully appreciate his work. Mr. Wadhams will tell of the work of the Committee on Membership of which he has been Chairman. To state our membership I can say that I sent out 515 notices of the annual meeting now being held. From Engineering Journals was learned the deaths of F. E. Hine and R. C. Coggeshall. Also notices have just been received of the deaths of W. E. Colgan and A. Clark Hall. As an officer I bid farewell. For 39 years I have been a very active member and for 23 years an officer-holder; having held all the offices listed and a self-styled "Committee on Advertising" for 23 years.

H. J. Kellogg, *Secretary.*

Report accepted.

The President: Next will be the report of Committee on Meetings,—Mr. E. I. Rudd, Chairman.

REPORT OF COMMITTEE ON MEETINGS.

In making this, its second report, the Committee on Meetings will be brief.

During the year 1922-1923 there have been held seven meetings, as follows:

Bridgeport: March, 1923, visits to sewage disposal plants at Bridgeport and Stratford. Supper at Stratfield Hotel and a talk, "Construction methods on Detroit Municipal Street Railway" by W. R. Dunham, Jr.

New Britain, April 12, "Bunce Anniversary Meeting," Inspection of Gas-fired brick-burning oven, and shop methods at Berlin Construction Co. Chicken dinner at Y. M. C. A. and talk on "Uses & Properties of Cement" by Charles E. Price, New Haven, Conn.

New Haven:—May 15, Inspection of various city pavements; Supper at Hotel Garde, talks on Highway Construction Practice by Deputy Commissioner R. L. Saunders of Connecticut, and A. H. Henderson, office Engineer, State Board of Pub. Roads of Rhode Island.

Storrs: July 25, Summer Meeting. A lovely drive, athletic sports, chicken dinner, speech by C. L. Beach, President of Conn. Agric. College, on What Connecticut Aggie does for Connecticut," and an inspection of the educational plant at Storrs. This was a dandy meeting and 225 fellows were present.

Middletown: Sept. 18, Inspection of manufacturing processes of Cement Brick and of Noiseless Typewriters. Supper at the Palm Restaurant (a good one too) and talks by George A. Wilson of the Laurel Brick Co. and R. E. Benner of the Noiseless Typewriter Co. The day was lovely, but the membership frigid, and many fell by the wayside, the attendance dwindling to about ten by speechmaking time. Very discouraging, and the meeting place is only 40 minutes drive from at least 200 members.

Danbury:—December 4. Hat making in all its branches, supper at Hotel Green, talk on "The work of the Connecticut Public Utilities Commission," by E. I. Rudd.

New Haven: —January 15. An evening meeting and smoker, buffet lunch and atmosphere; talk on "Tramways of Europe," by A. L. Donnelly, Div. Engineer of the Connecticut Company.

This committee has been arranging our society meetings for the past two years and recommends the holding, in addition to the two regular meetings, of six local meetings. It is also recommended that the society pay for the eats, securing funds for this by an increase of one dollar in dues or an assessment on the membership of that amount. Judging the future by the past, the attendance will average fifty; at $1.25 each, the total expenditure for the six meetings would be $375.00, leaving about a 15% margin for errors and omissions. It is also suggested that a record be made of those attending these meetings.

The members who have assisted in making these meetings a success are hereby cordially thanked.

Respectfully submitted,

E. Irvine Rudd,
Chairman, Committee on Meetings.

Mr. Kellogg: Do you recommend that there shall be exactly six meetings?

Mr. Rudd. Yes.

Mr. Kellogg: Where will you find places to hold them?

Mr. Rudd: That is within the discretion of the Committee.

The President: The money that would come out of the Treasury to finance these meetings, would that be paid for something to eat?

Mr. Rudd: To pay for the lunches. For instance, during the past two years, certain members have attended nearly every meeting, at $1.25 each trip, which, with their dues, runs up to $10 or $12 a year. I think those meetings in various parts of the state, attended by an average of about 50 men, might well be paid for, at least the food, by the total membership.

Mr. Ross: You do not feel that if it were generally known that a free lunch went with the meeting, the attendance would increase so as to swamp the Society paying for it?

Mr. Rudd: It is a good way to increase the membership.

Mr. Kellogg: One dollar would not be enough to pay for those lunches. The extra dollar in dues is needed, not for lunches, but for general expenses of the Society.

Mr. Ross: Do you offer that as a suggestion, Mr. Rudd?

Mr. Rudd: It is so stated in the report.

Report accepted.

The President: The next business is the report of the Committee on Membership, Mr. J. P. Wadhams, Chairman.

REPORT OF COMMITTEE ON MEMBERSHIP.

Mr. Chairman: My report is brief. The Committee made a special drive before the Summer Meeting, as well as the Annual Meeting, to line up men for new members, and in addition the members of the Committee have worked individually throughout the year.

I believe there were nine men voted into the Society at the meeting at Storrs, and there are ten on the list, besides eleven more applications which were received too late to be placed on the program, but to be voted upon at this meeting.

While this list is not as large as might have been expected from the number of applications requested, the committee has done considerable missionary work, the results of which will probably be in evidence at a later date.

Respectfully submitted,

Committee on Membership,
J. P. Wadhams, *Chairman.*

Report accepted.

The President: We will now have the report of the Committee on Public Affairs,—C. E. Price, Chairman.

Mr. Price: There are two bills before the present state Legislature which we think the Society ought to support, as a Society. One of them is House Bill No. 531, An act concerning an appropriation for inspection of camps. It reads, "Section 1. $10,000 is hereby appropriated to enable the State Department of Health to investigate the water supply, sewage disposal and food supply of the recreation and labor camps in the state." As to the other one, a communication was received by our President and turned over to this Committee, from C. H. Pierce of the U. S. Geological Survey, in which he calls attention to the fact that there is to be presented to the Legislature a bill—House Bill 524—"an act concerning stream gauging stations," calling for an appropriation of some $3,000 for the fiscal period ending June 30 1925 for "the establishment, operation and maintenance of stream gauging stations in co-operative investigation of the water resources of the state by the State Department of Health and the U. S. Geological Survey." The United States Government does all the work. These two bills in particular seem worthy of our consideration, and we recommend that the Society take action on them. As to any other bills that may be referred to our Committee, it is natural to assume that if, under the approval of the Board of Direction of the Society, we go to our representatives and senators on such bills, the members of the Society will give their support to them.

The President: The time to do the best work on these bills, it seems to me, is at the committee hearings.

Mr. Bush: Asking the Legislature for $3,000 for stream gauging stations is a waste of money. New England has done a great deal toward investigating its water power possibilities. There isn't a stream in Connecticut that has water power possibilities but what has been investigated, and people that own water powers have full knowledge of what they are worth. The United States Government might better spend money for this purpose in the Rocky Mountains or other places where the land is not fully occupied. Why they should come in here and take stream gaugings, runs offs, etc., where that information is already at hand, I do not see.

Mr. Price: For the information of this meeting I will read a part of Mr. Pierce's letter: "I am informed that a bill is now before the Connecticut Legislature which includes an item of $3,000 for the biennial period to June 30, 1925, providing for co-operation with the United States Geological Survey in establishing and maintaining stream gauging stations in Connecticut, a number of which were discontinued in 1921 because of lack of money." This indicates that the stream gaugings started by the U. S. Government have not been completed, and that this money is necessary so that the work already started may be completed and become of some value.

Mr. Bush: I was one of the observers on a stream gauging proposition, and collecting data, on the Connecticut River, for the Government, some years ago, and we reported the height of the river every day for several years. That record was published and made a lot of work in Washington, but I don't

know as those records were of any particular value. We knew about where the high water mark was, and the low water mark. While those records may be of some value, I have not been able to determine where they are of benefit to us. In bridge work we had our own records. I question whether it is worth the expenditure of any money by the State of Connecticut at the request of the United States Government.

Mr. J. Frederick Jackson: I think Mr. Bush has the wrong idea of the object of this act before the General Assembly. We have had stream gauging outfits on many of the rivers in Connecticut. We have had a stream gauging station on the Housatonic River for a number of years, and the record is pretty continuous. We have had private stations maintained at Falls Village and at Bulls Bridge to some extent. There has been a government station maintained on the Shetucket River for some time, which was discontinued for lack of money, and one on the Quinnebaug River. There have been stream gauging stations on the Connecticut, at different times. So far as the records show, a continuous record of the run off of the rivers of the state has not been maintained, and is not available in Connecticut at any place except for the station on the Housatonic River. It is my belief that many interested persons in this state are anxious to have this bill put through and to have these records maintained. They have written to the committee, stating these records were of great value to them and should be continued. That is from the standpoint of the generation of electrical energy. The value of these records is not confined to that. We have in this state some 98 water companies and very few of them that I know of know anything about what the run off is on their drainage areas and watersheds. For the past five to eight years the run off has been above normal. We know that from what records there are. Within the next few years we will have a period of drought, when the water companies will have to hustle to find out what they can do. At that time, if we had good records of stream gauging and run offs, supplied by the state, we would be able to act more intelligently. I don't know of a water company, except one or two, that can tell you what they expect the yield will be, with any degree of accuracy. We have such records as the Sudbury basin, the Croton basin, and the Wigwam basin, but the records of such watersheds cannot be utilized in estimating for the small watersheds,—½ to 2 sq. miles,—in Connecticut. I think Mr. Bush has rather an erroneous idea of the object of this bill. The power companies themselves state the necessity and value of the work. The expense to the state is $1,500 a year. The United States Government buys the gauges and installs them, and sends a man around to check up the readings. The state contributes $1,500 to pay the traveling expenses for this man. If I am correct, Connecticut is the only state in New England that does not have a definite and continuous record of the run off of its rivers.

Report accepted. (No action taken on recommendations.)

The President: The next business is the election of new members.

Mr. Kellogg: The following applications have been announced on the notices for this meeting, and the Board of Direction has approved said applications as follows:

Active Members—Raymond J. Bieth, Frank G. Flood, George M. Gearhart, Joseph O. Kelly, Clayton H. Lindsey, Richard I. Minniman, Lynton R. Newhall, Ray J. Reigeluth, Elmer E. Trench.

Associate Member—Frank R. Bryant.

It was voted that the Secretary cast one ballot for the candidates above named.

Mr. Kellogg: Other applications that have come in since the program was printed, and that have been approved by the Board of Direction are as follows:

Active Members.—R. Elmer Curtiss, George W. Dean, John F. Doonan, Joseph W. Holden, Constante A. Giordano, Giles B. Keeny.

Associate Member.—Charles S. Maschal.

Mr. Wadhams: Have you any other applications that you have not read?

Mr. Kellogg: No, sir.

Mr. Wadhams: I think there should be three more.

Mr. Ross: We have not been strict in these matters and are interested in getting in good members. Would it be the pleasure of this meeting to have Mr. Wadhams report on these three that he refers to,—there will not be another opportunity to elect members until the summer meeting? Suppose he reports on these men, and then have this meeting approve of their becoming members, subject to the endorsement of the Board of Direction.

Mr. Jackson: Would it be possible to vote on these tomorrow? In the mean time we could get their applications. It would be better to have their applications before us.

Mr. Elwell: I think Mr. Jackson's suggestion is a good one.

Mr. Ross: I think so. Those last three, we will bring up again tomorrow. If those applications have been lost in the mail, we can decide tomorrow, whether we wish to elect them without having their applications before us.

Mr. Terry: I move that the men on the list of applicants as read by Mr. Kellogg, be accepted and that they be declared elected. (Motion seconded, and it was so voted.)

The President: Next is the report of the Committee on Affiliated Societies, Mr. J. F. Jackson, Chairman. You have had for some time this little pamphlet prepared by Mr. Jackson.

AFFILIATED ENGINEERING SOCIETIES.

For the past two years there has been a concerted effort on the part of men in all branches of Engineering to secure a closer bond of union between the different branches of Engineering and the individual members thereof, for promoting social intercourse, advancing Engineering sciences, and the participation of Engineers in public affairs so that they may render their particular communities service by advice on Engineering matters. A Conference was held March 11, 1922, in the Mason Laboratory in New Haven

attended by about 50 Engineers; 30 were delegates representing 17 organizations. At this Conference were present 10 members of the Connecticut Society of Civil Engineers. The following resolutions were unanimously adopted:—

Resolved: That it is the sense of this Conference that a state-wide affiliation be created to further the public welfare through the use of technical knowledge and Engineering experience, and to consider and act upon matters of common concern to the engineering and allied professions, the engineering societies and clubs and the members of each, for the purpose of promoting the interests of all.

Resolved: That it is the sense of this Conference that the proposed affiliation should be an affiliation of organizations and not of individuals.

Afterwards a proposed Constitution was discussed and it was

Resolved: That a committee be appointed to draw up a Constitution and By Laws. That this committee consist of the present chairman and secretary, in conjunction with one appointed delegate from each organization represented in the conference; and that the constitution and by-laws be submitted by such delegates to their respective organizations for ratification.

Subsequently, 11 delegates met May 12, 1922, at the Hotel Garde, New Haven, and, after thorough discussion, a Constitution and By Laws were adopted which were to be submitted for approval to the different organizations represented. The delegate from your society reported to the summer meeting held at Storrs College, recommending the adoption of the proposed Constitution and By Laws and that the Connecticut Society of Civil Engineers enter the affiliation. It was voted to send out an explanatory letter with the call for the next Annual Meeting and that definite action be postponed until then. Your attention is called to the fact that at the first Conference the principal objection to joining the affiliation by our society arose over the matter of dues. It was left to your delegate, who thinks that this has been satisfactorily adjusted by Article 5, Expenses and Funds; and Article 6, Limitation of Authority, quoted herewith:

ARTICLE V. *Expenses and Funds.* The ordinary expenditures of the Council shall be limited to clerical expenses of the officers.

Funds shall be provided by an initiation fee of ten dollars from each member society, with future assessments to be laid by the Council, but not exceeding ten dollars per annum for each member society.

ARTICLE VI. *Limitation of Authority.* The Council shall not interfere with the maintenance of the autonomy, functions and operations of each. It shall however, encourage the development of the member societies and interest itself in their activities, particularly in matters relating to co-operation of neighboring societies.

It is the opinion of your delegate that the Connecticut Society should join the Affiliated Engineering Societies of Connecticut.

J. FREDERICK JACKSON, *Delegate.*

Mr. Jackson: I do not think of anything to add. My position in the matter is that of unofficial observer. I have endeavored to put into the compass of this abstract, the essential points as I see them, of this affiliated engineering society matter. You have had opportunity to read it. I was impressed by the evident desire on the part of these representatives to get together on some common ground, all branches of engineering. I understand the affiliation is functioning in Boston, and I am told going very well in one or two other places. I even understand it is unofficially functioning here in Hartford. Joint meetings of the different branches of the engineering profession have been held and I believe one is contemplated. So that actual affiliation, while not an accomplished fact by an organized body, is really being accomplished by the societies, unofficially. I was impressed by the earnestness of the men engaged in this movement. It seems to me it would be a good thing for all engineering branches to have some affiliation with each other, and as finally recommended these by-laws seem to be needed and I am in favor of them.

Mr. Elwell: I have never been in favor of any such movement. I am not in favor of it now, neither for this Society, nor for the American Society of Civil Engineers. We have our own particular feelings, and there are too many affiliations already. If we attend to our own business, we will have plenty to do. I am against it.

Mr. A. B. Hill: It does not seem to me that the federation of these societies is going to help the Connecticut Society of Civil Engineers. I think it will have the reverse effect. I am reminded of the saying of a distinguished editor: "Mind your own business, and in time you will have a business of your own to mind." That is sound advice.

Mr. C. J. Bennett: I move this report be tabled indefinitely. I refer to the question of affiliation.

Motion carried by vote.—19 ayes, 15 noes.

The President: We will now have the report of Committee on Papers, —Mr. L. F. Peck, Chairman.

Mr. Peck: The program speaks for itself, but as a matter of form I will announce for the committee,—composed of Messrs. Saunders, Buck, McKaig, and myself, that the committee secured the following speakers: Richard J. Kinsella; John H. Dunlap; C. J. Bennett; Hugh L. Cooper; H. S. Busby; Robert P. Butler; Hiram Percy Maxim; Edward S. Nettleton; Theodore R. Kendall; Frederick C. Moore; and Charles Rufus Harte. The committee is very grateful to these gentlemen for their accommodation, and appreciates their co-operation.

Report accepted.

The President: The next business in order is the election of officers, but as the tellers are not quite ready, the address of the President is in order.

(This address may be found in the front part of this book.)

The President: We will now have the report of the tellers.

Mr. Storrs: Total number of votes cast, 259.

For President, Alfred H. Terry, 255.

For First Vice-President, Leon F. Peck, 253. Scattering, 1.

For Second Vice-President, Charles W. Eddy, 166; Charles A. Wheeler, 80.

For Director, E. Irvine Rudd, 212; H. J. Kellogg, 16. Scattering, 1.

For Secretary and Treasurer, Clarence M. Blair, 170; Alden Wells, 79.

THE PRESIDENT: I therefore announce that you have elected for officers for 1923—

President, Alfred H. Terry.
First Vice-President, Leon F. Peck.
Second Vice-President, Charles W. Eddy.
Director, E. Irvine Rudd.
Secretary and Treasurer, Clarence M. Blair.

It is customary to call upon the new president for a few remarks.

MR. A. H. TERRY: I wish to thank you very much for the honor you have conferred upon me, and I will try to be, as nearly as possible, as good a President as my predecessors in office. I thank you.

THE PRESIDENT: The next in order is miscellaneous business.

MR. BUSH: I have an amendment to the constitution, if that comes in now, dealing with the office of the Secretary and Treasurer. This is an amendment to the constitution, duly signed by Henry R. Buck, C. J. Bennett, and C. C. Elwell, and myself. The purpose of the amendment is to have the Secretary and Treasurer appointed by the Board of Direction, who will also fix his salary. It goes with either position—as Secretary and Treasurer, or one position as Secretary and another as Treasurer—whether there are one or two persons filling these positions.

After considerable discussion a motion was made and seconded that the meeting approve this amendment. Motion was lost,—ayes 8, noes 20.

THE PRESIDENT: Is there any further business to bring up at this time?

MR. TROWBRIDGE: Several communications are sent out to all members, at various times, during the year. You can imagine the labor necessary to address 500 communications, once a month, or once a week, or whatever it is. I have investigated addressing machines and got a line on a good one, and for an investment of less than $100 the Society can get full equipment to take care of a list of up to 1,500 names, including machine, cards, and filing cabinet, and making stencils for the plates. I move that it be the sense of this meeting that the Society purchase an addressing machine, either through a committee appointed by the President, or through the Board of Direction.

MR. BUSH: I think it is uneconomic for the Society to purchase a machine that probably would be used only a few times each year. Probably those communications could be addressed on some other machine. I believe the Board of Direction can institute methods which will result in economy and saving of labor on the part of the Secretary. This is a matter which should be left to the Board of Direction, in my opinion.

Mr. Kellogg: I think I have had more addressing to do than previous secretaries. I was able to get through it, and I am an old man. I don't see where the $100 is coming from. We are running this Society on the smallest dues of any society I know of.

Mr. Blair: If Mr. Kellogg can address the envelopes, I think I can do it. Under the present financial condition of the Society, we ought not to spend the money for a machine. I am concerned about where the money is coming from to publish the 1923 year book. If my understanding is correct, we must take the 1923 dues now coming in, to pay for the year book that has just been published. It seems to me we should get on some financial basis where we can pay our bills as we go along, and not have to rub along with notes advanced by someone to meet our obligations.

Mr. Terry: I understood the dues now coming in would amount to something over $2,000 and that we owe $1,800.

Mr. Blair: I understood Mr. Kellogg to say that the dues coming in will pay for the 1921-1922 year book.

Mr. Kellogg. I think that is correct, as nearly as I can estimate the bill of Tuttle, Morehouse and Taylor, for printing, including the envelopes the books were sent out in, and addressing them, and postage. I cannot tell you exactly, as I haven't the items before me.

Mr. Blair: I am figuring on the total year's dues.

Mr. Kellogg: I think you will about break even, with what you take in, and probably will be able to pay last year's bills, but there is no way of publishing that book every year on dues of $4.00.

Mr. Price: By getting competitive bids for that publication, we could cut down the cost.

Mr. Kellogg: There can be economy in publishing the book if you want to change the style of the type, so as to get more on each page. The people who have printed this book have financed it for us, and have helped me wonderfully. You can put it on a competitive basis, but I doubt if you will get good service or save much money.

Mr. Elwell: Why not get this book on a basis where we will not be paying out the incoming dues for the book already published? Why wouldn't it be better to skip another year and let the next book come out in 1924?

Mr. Kellogg: The Board of Direction has the power to levy and collect one special assessment, not to exceed two dollars, at such time as the Board may deem expedient. This was authorized at the last annual meeting.

Mr. Blair: The book should come out every year, and I hope that some way may be found to publish it regularly. It might be a good plan to levy the assessment this year to help finance the publication.

Mr. Jackson: I think this is a matter for the Board of Direction to settle, in conference with the Secretary. Of course, the Society wants to have the book published. It is up to the Board of Direction to care for the financing of it.

Mr. Terry: I am inclined to agree with Mr. Jackson that the Society as a whole would like to have the book published. I recall the provision for

a $2 assessment. I am inclined to think it is up to the Board of Direction and the incoming officers, to find a way out.

MR. BUSH: The Board of Direction does not have much to do with publishing that report. The constitution says the Secretary shall publish the report, so any remarks should be aimed at the Secretary. The Board can finance it, but has nothing to say as to what goes into it.

MR. A. B. HILL: It is my own feeling, and I think that of the Society in general, that the book should be published every year, as other societies do. There was a resolution passed, authorizing the Board to make a special assessment. If it is necessary to make such an assessment, I think it should be done. In any case I think we should have that publication every year.

MR. ELWELL: Could we decide this question at our summer meeting? Would that be soon enough?

MR. TERRY: I think we would know better then, what we can do. There is no desire at this meeting, I think, to authorize a further assessment, nor do I take it that the meeting wishes to direct the Board to make that assessment.

MR. HILL: The Board was authorized to make a special assessment.

MR. TERRY: They were not directed to.

MR. ROSS: I think that authorization still stands. If the incoming officers cannot settle this question, it may be submitted to our summer meeting.

Adjourned at 12.28, noon.

Reconvened at 2.12 P. M.

PRESIDENT ROSS: You will notice that our first number on the program for this afternoon is an address of welcome by Mayor Richard J. Kinsella of Hartford. Mr. Kinsella is laid up with the grippe, and in his absence the President of the Court of Common Council functions for him, and that changes the political situation entirely. However, I have cautioned the speaker that this is no time for politics. I am going to call on Alderman Norman C. Stevens, President of the Court of Common Council.

ADDRESS OF WELCOME.

MR. STEVENS: Mr. President and Gentlemen: The President of your Society has said that we cannot talk politics. I am glad of that, because in my short experience in politics I have had opportunity to talk once in a while, and I find that if your batting average in politics shows that you have 51% of the people in back of you, it is a pretty good average. You may set things out and arrive at what you believe to be logical conclusions, but there are very few people, apparently, who believe as you do. If they do, they keep quiet about it. If they don't, they let you know. Far be it from me, a Republican, to take advantage of the Mayor, who happens to be a Democrat. I would far rather the Mayor were here to address this gathering, because I know that he, with his additional years of experience, could bring to you a real message.

In the great problems of our modern civilization we depend more and more upon you engineers. I have always believed that an engineer was sort of like a judge, and approaches things trying to get to the point in the most direct way. To carefully judge both sides of the question and think out the reasons and the whys and wherefores, he must have a very good imagination and also a practical training to enable him to weigh his subject and give it careful consideration.

Here in Hartford we are proud of the works which men of your training have built for us. Our beautiful Connecticut River bridge; our State Capitol; our Municipal Building; our State Library. Even back in the days of old King Tut they did a lot of good things. You have advanced since then, and the business in which you are engaged surely must be a wonderfully interesting business. As I see it, every proposition you tackle is a new proposition, and must be full of interest to you; and when you get through, you have something to show for your work. The results of your work are apparent in some beautiful bridge or building, or some wonderful water works proposition, whereas some of the rest of us labor and toil, and receive our remuneration, but when we get through we have nothing that we can point to. It has gone out in dividends, or occasionally in losses.

I know that civil engineers are really civil, because I have had some experience in municipal affairs with them and have found them to be a very civil class of men. They always meet you in an agreeable sort of manner, and thus live up to the first part of their title; and when you look over the works which they accomplish, and the problems which are turned over to them, and the manner in which they work out those problems for the best interests of the city, we feel sure they are living up to the last part of their title. I know that the City of Hartford feels proud to-day in having here a class of men such as you are, who mean so much to any community, and, while we cannot extend to you some of the old time hospitality which was occasionally furnished in Hartford, I am sure that nevertheless the welcome to you which the City extends is no less warm, and comes straight from the heart.

The City of Hartford is indeed glad to welcome you to Hartford, to-day. I know, from the subjects which you are to consider and the addresses which are to be heard, that you will go away from this meeting with new thoughts, and with more information than you had when you came here. You have the opportunity of rubbing elbows with others in the same line of business. I trust those of your number who come from other parts of the state will carry away with you a pleasant recollection of the City of Hartford, and of the time which you have had while with us. Gentlemen, I thank you.

THE PRESIDENT: We all know what the secretary of a state organization looks like. We have had Kellogg to look at, and now we have Blair. We have such a good organization here that sometimes we wonder what can be left for a national society to do. Some of the members of this Society are members of the American Society of Civil Engineers. And a good many of us who are not members of the American Society probably are looking

forward to the time when we can feel that we can make application for membership in that Society,—having the necessary experience and cash. We are glad to have here to-day the Secretary of the American Society of Civil Engineers, who is going to tell us what that Society stands for, what they are doing, and why we should want to be members: and I hope that after the speaker gets through that a good many of us will feel even more strongly than ever that we want some day to be members of the American Society of Civil Engineers. I call on Mr. John H. Dunlap, Secretary of the American Society of Civil Engineers.

Note. (Mr. Dunlap's address is printed elsewhere in this book.)

THE PRESIDENT: As a fitting introduction for the next speaker I desire to read a few paragraphs from "*Outlook*" of January 31, 1923. (Reads article.) This is the best introduction I can give Colonel Hugh L. Cooper, Consulting Engineer, New York City, who will speak to us on the subject, "The New St. Lawrence."

(Colonel Cooper's paper is printed elsewhere in this book.)

THE PRESIDENT: Mr. Bennett, the State Highway Commissioner, is on the program for this afternoon, but his work detains him at the Capitol. We will therefore make a change in the program. Our next speaker will be one of our own members, Charles Rufus Harte, Construction Engineer, The Connecticut Company, who will give us some points on public utility valuation.

(Mr. Harte's paper is printed elsewhere in this book.)

THE PRESIDENT: Next on the program is a talk by Mr. Hibbard S. Busby, Research Colorist, Cheney Bros., Manchester, Conn. I know Mr. Busby. He is an engineer, and a regular fellow.

(Mr. Busby's paper is printed elsewhere in this book.)

Meeting adjourned at 5:00 P. M.

EVENING SESSION.

A reception to the newly elected officers was held at the Hartford Club at 6:00 P. M. Following this reception, at 6:30 P. M., the annual dinner of the Society was enjoyed by the members and guests. One hundred and twenty were in attendance at the dinner.

After the dinner Mr. Robert P. Butler, Corporation Counsel of the City of Hartford, addressed the meeting on the need of a cultural education. Mr. Hiram Percy Maxim, President of the American Radio Relay League, gave a very instructive talk on the development of radio. Mr. Charles J. Bennett, State Highway Commissioner, read a paper on the "Road Situation in Connecticut."

Note. (These three addresses are printed elsewhere in this book.)

Morning Session.

Wednesday, Feb. 21, 1923.

Meeting convened at 10:24 A. M.

The President: We will first take up the election of new members.

Mr. Kellogg: Since the business session yesterday I have received the following applications. These have all been duly endorsed by the Board of Direction. For active members, William H. Brainard, Edward P. Fitzgerald, William J. Fritz, Clinton D. Hanover, Jr., James H. Hendry, Bryant F. Sarles, John W. Smith, Hans R. Stamm; for associate member, Sylvester J. Bagley.

It was voted that these applicants be admitted to membership in the Society as indicated.

The President: Our first speaker, Mr. E. S. Nettleton, is a member of our Society, and is the City Engineer of New Haven. He is going to talk to us on the Tomlinson Bridge in New Haven, which I understand has been started, although there is considerable work yet to be done on it.

Note. (Mr. Nettleton's paper is printed elsewhere in this book.)

The President: One of our members, Mr. A. S. Lynch, has asked for the privilege of the floor at this time.

(Mr. Lynch in a short speech presented to Mr. H. J. Kellogg a purse of gold, on behalf of the officers and members of the Society, in appreciation and remembrance of his long and faithful services to the Society.)

The President: Our next speaker is Mr. Theodore R. Kendall, Engineering Editor of the "American City." Mr. Kendall's subject is "The Garbage Disposal Problem in American Cities."

Note. (Mr. Kendall's paper is printed elsewshere in this book.)

The President: The last speaker on the program is Mr. Frederick C. Moore, Assistant Secretary of the Hartford Fire Insurance Company. Insurance companies have many problems in engineering, and Mr. Moore's subject is "The Relation of Engineering to Fire Insurance."

Note. (Mr. Moore's paper is printed elsewhere in this book.)

The President: On the adjournment of this meeting we are invited by the Hartford Fire Department to step across the street to the Central Station, and see the new fire alarm system, which I am told is very interesting. All those who plan to take the trip to the Cheney Mills will please meet at the State Street car barn at 2 o'clock.

A Member: I offer a motion to request the secretary to express the appreciation of the Society to the Hartford Electric Light Company, and to Mr. A. D. Colvin, its General Manager, for the courtesies extended to the Society for this meeting. Also to Mr. Barton, who has assisted with the stereopticon; to the Board of Fire Commissioners for their invitation to inspect the fire station; to the Connecticut Company for the donation of a special car for the Manchester trip; to Cheney Bros. for their invitation to see the operations at their silk mills; and to all the speakers who have so generously contributed to the success of our meeting.

(Motion seconded and carried by rising vote.)

Meeting adjourned at 1:00 P. M.

(Many members availed themselves of the privilege of inspecting the Central Fire Station, where the Chief and his assistants courteously explained the details of the station.

In the afternoon about 75 members went, by special car, to South Manchester, where they were met by officials of Cheney Bros. and conducted through the silk mills.)

CONSTITUTION

ARTICLE I.

NAME AND OBJECT.

SECTION 1.—The name of this Society shall be THE CONNECTICUT SOCIETY OF CIVIL ENGINEERS, INCORPORATED.*

OBJECT.

SEC. 2.—The object of this Society shall be the professional improvement of its members; the encouragement of social intercourse among men of practical science, and the advancement of engineering in its several branches, to wit: Civil, hydraulic, naval, sanitary, mechanical, electrical, architectural, mining, geological, metallurgical, and chemical; the reading and discussion of papers, and the hearing of lectures on any of the above topics relating to engineering science, and the transaction of all business properly belonging to said Society.

ARTICLE II.

MEMBERSHIP.

SECTION 1.—The membership of this Society shall consist of Members, Honorary Members and Associate Members.

MEMBERS.

SEC. 2.—Members must be at least twenty-one years of age and have had two years' actual experience in some branch of engineering or surveying, or shall have been graduated from an engineering course in a college or university of recognized standing, and they only shall be entitled to vote or transact business for the Society.

HONORARY MEMBERS.

SEC. 3.—Honorary Members may be as many as the Society shall elect. They shall have no vote, nor shall they be eligible to hold office. They shall have the right to attend all public meetings and to enjoy such other privileges as the Society may see fit to grant, excepting, however, such Honorary Members as may be elected from *active membership,* when they shall retain their right to vote and to hold office.

ASSOCIATE MEMBERS.

SEC. 4.—Any person desiring to become associated with this Society, who is not eligible to active membership, may make application, and if

---

*Incorporated under the laws of the State of Connecticut, August, 1920.

said application receives a favorable report from the Board of Direction, it shall be acted upon by the Society at the next regular meeting, and if said candidate shall receive a majority of the votes cast he shall be declared elected as an Associate Member. Associate Members shall have no vote, nor shall they be eligible for any office.

ARTICLE III.

OFFICERS AND THEIR DUTIES.

OFFICERS.

SECTION 1.—The officers of the Society shall be a President, two Vice Presidents, a Secretary and Treasurer, an Assistant Secretary, and four Directors, one of whom shall be the last living ex-President.

ELECTION OF OFFICERS.

SEC. 2.—The officers, excepting the Assistant Secretary and the Director who is the last living ex-President, shall be elected at the annual meeting, and shall hold their respective offices until the final adjournment of the meeting in which others are elected and qualified in their places.

PRESIDENT.

SEC. 3.—The President shall preside at all meetings when present. He shall be chairman of the Board of Direction, and of all standing committees, and shall appoint all special committees, unless otherwise ordered by a vote of the Society.

VICE PRESIDENTS.

SEC. 4—In the absence or inability of the President to act, the Senior Vice President present shall perform his duties.

SECRETARY.

SEC. 5.—The Secretary shall attend all meetings of the Society and the Board of Direction, and shall keep the minutes thereof. He shall conduct the general correspondence of the Society, receive communications addressed thereto, and present the same to the proper committees, officers, or meetings. He shall issue notices of all meetings, inform committees of their appointment, and officers and new members of their election. He shall notify all committees of coming meetings and prepare the matters for presentation. He shall keep a complete list of all members, with their addresses and dates of election. He shall publish the annual report. He shall perform such other duties pertaining to his office as may be imposed upon him by the Society or by the Board of Direction, and shall receive a salary to be fixed by the Society.

TREASURER.

SEC. 6.—The Treasurer shall keep the accounts, collect all the funds of the Society and shall deposit the same to the credit of the Society

in such depository as may be designated by the Board of Direction. He shall pay all bills, when approved by the President or a majority of the Board of Direction. He shall keep book accounts of his receipts and expenditures, which shall at all times be open to the inspection of the Board. He shall make a duly audited itemized report to the annual meeting. He shall give bonds for the faithful performance of his duties, in such amounts and with such sureties as the Board of Direction may require, and he shall receive such remuneration as the Society may vote to him from time to time. The books shall be audited by Auditors appointed by the Society at its annual meeting.

ASSISTANT SECRETARY.

Sec. 7.—The Assistant Secretary shall be appointed annually by the President, and his duties shall be such as would pertain to the office of executive secretary.

BOARD OF DIRECTION.

Sec. 8.—This Board shall consist of seven members: the last living ex-President, ex-officio; a President; a First and Second Vice President; and three Directors. The President and two Vice Presidents shall be elected annually to serve one year. One Director shall be elected each year to serve for three years, and he shall not be eligible for reëlection to that office until one year has elapsed after his term of office has expired.

The President or one of the Vice Presidents shall preside at all meetings of the Board in the order of seniority. In the absence of all of these officers, a chairman *pro tem.* may be appointed for the meeting.

Four members shall constitute a quorum for the transaction of business.

ARTICLE IV.

ELECTIONS.

OFFICERS, WHEN ELECTED.

Section 1.—At each annual meeting the Society shall elect by ballot a President, two Vice Presidents, a Secretary and a Treasurer, to serve one year, and a Director to serve three years.

NOMINATIONS, HOW MADE.

Sec. 2.—A nominating blank, containing a list of officers to be voted for, shall be sent by the Secretary to each member, at least sixty (60) days before the day of the annual meeting. The nominations for officers shall be returned to the Secretary in an envelope endorsed with the member's signature, within twenty-one (21) days from the date upon which the blanks were mailed to members, and shall be delivered by him, unopened, to the Board of Direction at a meeting to be held by them to canvass such nominations.

A member nominated for an office by as many as ten (10) other members may become a candidate for that office. If a member be nominated

for more than one office, he shall be considered as having been nominated for that office for which he received the most nominating ballots.

If no member receives ten (10) nominating ballots for an office, or if for any reason there should be no candidate for an office, the Board of Direction shall nominate at least two candidates for that office.

All nominees for office shall be notified at once by the Secretary of their nomination and, unless the Secretary receives a prompt declination, it shall be assumed that they have accepted such nomination.

ELECTIONS, HOW CONDUCTED.

SEC. 3.—At least twenty-one (21) days before the annual meeting the Secretary shall send each member a ballot, containing the names (arranged alphabetically) of the candidates for each office. This shall be accompanied by an envelope addressed to the Secretary, with a blank space on the back for the signature of the member voting, also a blank envelope carrying no mark for recognition.

Each member shall signify his choice by placing a cross opposite each name voted for, or by writing the names, and shall return his ballot to the Secretary in two sealed envelopes; the inner one to be left entirely blank, and the outer one endorsed with signature of sender.

Ballots may be sent by mail to the Secretary or handed to him directly. The Secretary shall deliver the ballots, unopened, to the tellers appointed by the presiding officer.

The polls will close at eleven o'clock in the morning of the day of the regular annual business meeting of the Society.

MEMBERS IN ARREARS CANNOT VOTE.

SEC. 4.—It shall be the duty of the Treasurer to furnish the tellers with an alphabetical list of members in arrears for dues for two years or more, and no vote from a member so in arrears shall be counted. Ballots received from such members shall be returned to them unopened with a statement of the reason for such action.

PLURALITY ELECTS.

SEC. 5.—The candidate for each office receiving a plurality of the votes shall be declared elected. In case of a tie vote, the meeting shall proceed to vote by ballot for the candidates who are tied.

NOTIFICATION.

SEC. 6.—The Secretary shall officially notify in writing each officer of his election.

Officers so elected shall qualify and assume their duties immediately after the adjournment of the meeting at which they are elected, and shall hold office until their successors are duly elected and qualified.

VACANCIES.

SEC. 7.—Vacancies occurring for any cause in the list of officers shall be filled by the Board of Direction.

ELECTION OF MEMBERS.

Sec. 8.—Each application shall be announced on the notices for the next meeting after it is received, shall then be considered by the Board of Direction, and, if approved, shall be presented to the Society for ballot at a regular meeting. If a candidate receives a majority of the ballots, he shall be declared elected. In case of rejection, no minute shall be published, but the Secretary shall notify the applicant by letter.

APPLICATION FOR MEMBERSHIP.

Sec. 9.—All applications for membership or for transfer from one grade of membership to another, shall be made by a regular form, to be secured from the Secretary, and to be endorsed by three Members. This form shall contain, immediately over the signature of the applicant, a clause in which the applicant shall agree that if elected he will be governed in all Society matters by the Constitution and By-Laws, and will forward the interests of the Society at all times.

ARTICLE V.

MEETINGS.

ANNUAL MEETINGS.

Section 1.—There shall be a *regular annual meeting* held on the third Tuesday of February of each year, at such place as may be selected by the Board of Direction, of which due notice shall be given by the Secretary.

MEETINGS, HOW CALLED.

Sec. 2.—Special meetings may be called by the President and, when so called, notice of the meeting specifying the business thereof shall be mailed by the Secretary to the postoffice address of each member at least ten days before such meeting shall be held. Special meetings shall be called by the President on written application of any ten (10) members.

QUORUM.

Sec. 3.—Ten per cent. of the membership shall constitute a quorum for the transaction of ordinary business, except for the election of officers or for voting on amendments to the Constitution or By-Laws, which shall require fifteen per cent.

ARTICLE VI.

DUES.

Section 1.—The annual dues of members and associate members shall be four ($4.00) dollars per year, payable in advance at the annual meeting.

Members elected at any time of the year shall pay full dues for that year.

Sec. 2.—Honorary Members shall pay no annual dues.

Sec. 3.—The Board of Direction shall have power to remit dues when, in their opinion, it is for the best interest of the Society.

SEC. 4.—Active and associate members who have reached the age of seventy years and who have paid dues as such for twenty-five years shall be exempt from further dues. Active and associate members who have paid dues as such for thirty-five years shall be exempt from further dues.

ARTICLE VII.

DEPRIVATION OF MEMBERSHIP.

SECTION 1.—Any member whose dues shall remain unpaid for one (1) year shall be notified by the Treasurer, by sending by registered mail a bill for dues in arrears, on the face of which bill shall be printed the sections of the Constitution covering such cases. If the dues are not paid within thirty (30) days after such notification, the matter shall be presented to the Board of Direction, who shall have power to drop such member from the roll.

RESIGNATIONS.

SEC. 2.—Resignations must be submitted in writing to the Secretary, and may be accepted by the Board of Direction when all indebtedness to the Society has been discharged.

SEC. 3.—All charges against any member shall be investigated by the Board of Direction before being submitted to the Society.

Any member may be expelled for conduct which may be deemed prejudicial to the Society, by a two-thirds vote of the Members present at a business meeting; provided, that not less than fifteen (15) vote for expulsion, and that such member shall have had one month's notice of the charges preferred against him and of the time appointed for their consideration. All charges must fully set forth the offense or offenses alleged, and must be signed by the members preferring them. An attested copy must be furnished the accused, who shall be entitled to be present and to be heard in defense, in person or by attorney, at all meetings at which the charges are investigated, except during the time when a final vote is being taken.

ARTICLE VIII.

AMENDMENTS TO CONSTITUTION.

SECTION 1.—Proposed amendments to this Constitution must be presented in writing at a regular business meeting of the Society, and signed by at least three members. Amendments so presented shall be read at the meeting and a copy filed with the Secretary at the same time. At the meeting when presented the proposed amendments may be discussed and amended, and if approved by the meeting shall be submitted to a letter ballot by the Society at the next regular business meeting.

SEC. 2.—At any regular business meeting the amendments previously proposed, according to Section 1, may be voted upon by letter ballot. These ballots shall be sent out with the call for the meeting and shall have the proposed amendment, together with the section of the present Constitution covering the point in question, printed upon the ballot With

the ballot shall also be sent an envelope directed to the Secretary and marked "Ballot on Amendment." The Secretary shall keep these letters unopened and present to the presiding officer all replies received up to the hour of closing the polls. Tellers shall be appointed by the presiding officer, who shall open and count all ballots. The result shall be announced at the meeting by the presiding officer. Two-thirds of the ballots cast will be necessary for the adoption of an amendment.

SEC. 3.—The Board of Direction is authorized to number the Articles and Sections of the Constitution and By-Laws to correspond with any changes that may be made.

BY-LAWS.

MEETINGS.

1. In addition to the regular annual meeting, as provided by the Constitution, the Society shall hold at least one other general meeting, and may hold such other meetings as may be called by the President for the presentation of papers, lectures or addresses, for visiting engineering works of interest, or for purely social purposes.

GENERAL ORDER OF BUSINESS AT ANNUAL MEETING.

2. The following general order of business shall be observed at annual meetings:

1. Presentation of, and action upon, minutes of last meeting.
2. Report of Board of Direction.
3. Report of Secretary.
4. Report of Treasurer.
5. Report of any Special Committees.
6. Election of new members.
7. Election of officers.
8. Address of President.
9. Miscellaneous business.
10. Papers, lectures or addresses.
11. Adjournment.

BUSINESS MEETING—ORDER.

3. The following general order shall be observed at Business Meetings:

1. Presentation of, and action upon, minutes of last meeting.
2. Miscellaneous announcements.
3. Stated business.
4. Adjournment.

4. Actual personal transportation expenses incurred by the Secretary in attending meetings shall be paid from the Society treasury, upon approval of the President or two members of the Board of Direction.

5. In the election of Honorary Members, a unanimous vote is necessary to elect.

6. The Society may at any time, duly named for the purpose, enact By-Laws for the future guidance, consonant with the Constitution. These By-Laws may be amended or repealed at any meeting, in the call for which meeting a copy of the proposed amendment or addition shall have been printed and sent to each member with the said notice.

PARLIAMENTARY RULES.

8. In all questions arising at any meeting, involving parlimentary rules, not provided for in these By-Laws, Roberts' Rules of Order shall be the governing authority.

VISITORS.

9. Visitors may be admitted to meetings under such rules as the meeting may prescribe.

10. All forms, such as blanks for application for membership, ballots for officers, ballots on amendments to Constitution or By-Laws, and other necessary blanks for the conduct of the business of the Society, shall be prepared by the Secretary and approved by the Board of Direction.

CHARTER MEMBERS OF THE SOCIETY

HONORARY.

Prof. John E. Clark*........................April, 1884

George H. Frost*..........................April, 1884

ACTIVE.

B. Hull*.....................................April, 1884

E. P. Augur..................................April, 1884

C. H. Bunce*................................April, 1884

L. W. Burt*..................................Jan. 13, 1885

C. E. Chandler..............................April, 1884

R. S. Hulbert................................April, 1884

C. M. Jarvis*................................April, 1884

H. J. Kellogg................................April, 1884

F. W. La Forge..............................Jan. 13, 1885

W. B. Palmer................................Jan. 13, 1885

S. C. Pierson*..............................Jan. 13, 1885

A. W. Rice...................................April, 1884

William G. Smith...........................April, 1884

Nelson J. Welton*.........................April, 1884

* Deceased.

Alphabetical List of Members.

With Addresses and Dates of Election.

Members are particularly requested to inform the Secretary at once of any changes in address.

HONORARY MEMBERS.

EDWIN P. AUGUR. Retired, 212 College St., Middletown, Conn. (*M. April, 1884*) ....Hon. M. Feb. 18, 1919

LESTER P. BRECKENRIDGE. Retired, Yale University, 400 Temple St., New Haven, Conn. ....Hon. M. Feb. 9, 1914

CHARLES E. CHANDLER. Chandler & Palmer, Civil Engineers, Room 114, Thayer Bdg., Norwich, Conn. (*M. April, 1884*) .... Hon. M. Feb. 18, 1919

RUSSELL H. CHITTENDEN. Professor Emeritus, Yale University, (Res. 83 Trumbull St.), New Haven, Conn. ....Hon. M. April 20, 1901

DESMOND FITZGERALD. Consulting Engineer, Brookline, Mass. ....Hon. M. Jan. 8, 1901

WILLIAM B. FULLER. Consulting Engineer, 219 South Central Ave., Eagle Rock, Calif. ....Hon. M. Feb. 12, 1908

DR. ARTHUR T. HADLEY. President Emeritus, Yale University (Res. 93 Whitney Ave.), New Haven, Conn. ....Hon. M. April 20, 1901

LEWIS M. HAUPT. Consulting Engineer: Cynwyd, Pa. ...Hon. M. Feb. 12, 1907

EDWARD C. HAYNES. 265 Liberty St., Lowell, Mass. ...Hon. M. Jan. 14, 1890

R. S. HULBERT. 267 Rockwell St., Winsted, Conn. (*M. April, 1884*) ....Hon. M. Feb. 18, 1919

HENRY J. KELLOGG. City Hall, New Haven, Conn. (*M. April, 1884*) ....Hon. M. Feb. 18, 1919

FREDERICK W. LA FORGE. Fort H. G. Wright, New London, Conn. (*M. Jan. 13, 1885*) ....Hon. M. Feb. 18, 1919

FLAVEL S. LUTHER, JR., Hartford, Conn. ....Hon. M. Feb. 9, 1904

WILLIAM B. PALMER. 211 State St., Bridgeport, Conn. (*M. Jan. 13, 1885*) ....Hon. M. Feb. 18, 1919

WILLIAM E. PETTEE. Salisbury, Conn. ....Hon. M. Jan. 10, 1899

ARTHUR W. RICE. Retired, 29 Cedar St., New Britain, Conn. (*M. April, 1884*) ....Hon. M. Feb. 18, 1919

FRANK W. SKINNER. Consulting Engineer, 243 W. 39th St., New York, N. Y. (Res. 774 Central Ave., Tompkinsville, N. Y.) Hon. M. Jan. 9, 1900

WILLIAM G. SMITH. Civil Engineer, 17 First Ave., Waterbury, Conn. (*M. April, 1884*) ....Hon. M. Feb. 18, 1919

MEMBERS AND ASSOCIATE MEMBERS.

A

ALGERNON B. ALDERSON. Civil Engineer, 43 Farmington Ave., Hartford, Conn. (Res. 139 Lake St., New Britain) ....M.	Jan. 10, 1899
GEORGE B. ALLEN. Mill Architect and Civil Engineer, 52 Vanderbilt Ave., New York City (Res. 132 Lyncraft Road, New Rochelle, N. Y.) ....M.	Aug. 12, 1908
GUSTAVE X. AMRHYN. Superintendent of Parks, City Hall, New Haven, Conn. ....Assoc. M.	Feb. 9, 1904
RALPH J. ANDREWS. 35 Appleton Ave., Pittsfield, Mass. ......M.	Feb. 11, 1913
WALTER T. ARNOLD. Civil Engineer and Architect, H. Wales Lines Co., (Res. 105 Elm St.), Meriden, Conn. ....M.	Aug. 8, 1917
GEORGE D. ARTHUR. With W. H. Arthur, Constructing Engineer, Stamford, Conn. (Res. Glenbrook, Conn.) ....M.	Feb. 17, 1920
WILLIAM H. ARTHUR. Constructing and Engineering, Stamford, Conn. (Res. Glenbrook, Conn.) ....M.	Feb. 17, 1920
NATHAN AYMAN. Asst. Engineer, Room 18, City Hall (Res. 635 Congress Ave.), New Haven, Conn. ....M.	Feb. 14, 1912
REUBEN B. AZHDERIAN. Asst. Engineer, Passaic Valley Sewerage Commissioners, P. O. Box 117, Newark, N. J. ....M.	Feb. 12, 1907

Ba

WILLIAM J. BACKES. Engineer, Maintenance of Way, N. Y., N. H. & H. R. R. (Res. 139 Fountain St.), New Haven, Conn. ..M.	Feb. 8, 1910
ARTHUR W. BACON. Civil Engineer, 272 Main St., New Britain, Conn. ....M.	Feb. 9, 1904
SYLVESTER J. BAGLEY. Track Dept. Connecticut Co., 58 Grove St. (Res. 117 Shultas Place), Hartford, Conn. ....Assoc. M.	Feb. 21, 1923
CLARENCE B. BALDWIN. Designer of Structural Steel, Berlin Construction Co., Berlin, Conn. (Box Q, Kensington, Conn.)..M.	Feb. 17, 1920
D. SCHUYLER BANTA. Civil Engineer, N. Y., N. H. & H. R. R. (Res. 217 Alden Ave.), New Haven, Conn. ....M.	Aug. 23, 1905
EDWARD B. BARKER. Engineering Force, West Hartford (P. O. Box 75, West Hartford, Conn.) ....M.	Feb. 17, 1920
GEORGE P. BARKER. Construction Engineer, H. Wales Lines Co., 134 State St. (Res. 163 Elm St.), Meriden, Conn. ....M.	Aug. 13, 1913
WILLIAM H. BARKER. Expert in Patent Causes, 160 Broadway, New York, N. Y. ....M.	Aug. 10, 1904
HERBERT W. BARLOW. Civil Engineer (Res. University Club), Bridgeport, Conn. ....M.	Aug. 14, 1923
JAMES E. BARLOW. City Hall, New London, Conn. ....M.	Feb. 21, 1922
SAMUEL E. BARNEY. Asst. Professor of Civil Engineering, Sheffield Scientific School, Yale University, New Haven, Conn.....M.	Jan. 9, 1900
W. VINCENT BARRY. Bridge Engineer, City Engineer's Office (Res. 174 Spring St.), New Haven, Conn. ....M.	Feb. 11, 1913
BURTON W. BARTLETT. The Bartlett-Brainard Co., 252 Asylum St. (Res. 17 So. Marshall St.), Hartford, Conn. ....M.	Feb. 15, 1921
FRANK R. BARTLETT. Estimator, 26 Church St. (Res. 21 Lambert Ave.), Meriden, Conn. ....M.	Aug. 17, 1909

Be

C. EDWARD BEACH. Civil Engineer, P. O. Drawer 13, Hartford, Conn. ....M.	Jan. 10, 1893
ELMER HIPPLE BEARD. Civil Engineer, Glenbrook P. O., Stamford, Conn. ....M.	Feb. 18, 1919
THEODORE W. BEARD. Construction Engineer, Chase Metal Works, Waterville, Conn. (Res. 71 Wooster St., Shelton, Conn.) M.	Feb. 10, 1914

ALLEN M. BEARDSLEY. City Engineer's Office, City Hall, Bridgeport (Res. 56 Maple St., Stratford, Conn.) ....M. Feb. 18, 1919

CHESTER A. BECKLEY. Engineer, The Merritt-Chapman & Scott Corporation, 17 Battery Pl., New York City (Res. 292 Pequot Ave., New London, Conn.) ....M. Aug. 11, 1920

CRESSON L. BEELER. Asst. Engineer, N. Y., N. H. & H. R. R., New Haven (Res. Leete's Island, Guilford, Conn.) ....M. Feb. 19, 1918

HOWARD L. BEERS. Eastern Engineering & Construction Co., Bridgeport, Conn. (Res. 134 Blakeman Place, Stratford, Conn.) M. Feb. 18, 1919

HOWARD K. BEIN. Civil Engineer, The Larkin-Carey Co., 166 Brewery St., New Haven, Conn. (Res. Long Hill, Woodbridge, Conn.) ....M. Feb. 20, 1917

ERIC W. BENEDICT. City Engineer's Office, Waterbury, R. D. No. 4, Waterbury, Conn. ....M. Feb. 21, 1922

CHARLES J. BENNETT. With The Edward Balf Co., 16 Haynes St. (Res. 187 North Oxford St.), Hartford, Conn............M. Aug. 14, 1906

EDWIN J. BEUGLER. Consulting Engineer, South Main St., Cheshire, Conn. ....M. Aug. 14, 1923

RAYMOND J. BIETH. Div. Engineer, N. Y., N. H. & H. R. R. Co., Waterbury passenger station (Res. 36 Wyman St.), Waterbury, Conn. ....M. Feb. 20, 1923

GEORGE L. BILDERBECK. Bilderbeck & Langdon, Inc., Engineers and Architects, Barrows Building, New London, Conn. ..M. Feb. 9, 1915

CARLTON T. BISHOP. Asst. Professor, Structural Engineering, Yale University (Res. 284 Alden Ave.), New Haven, Conn. ...M. Aug. 13, 1913

SAMUEL A. BITTNER. Estimating and Designing Engineer, Glenwood Park, New London, Conn. ....M. Feb. 15, 1921

Bl

FRANK L. BLACK. Civil Engineer, with A. H. Terry, 886 Main St. (Res. 1777 Noble Ave.), Bridgeport, Conn. ....M. Feb. 18, 1919

CLARENCE M. BLAIR. Civil Engineer, with A. B. Hill, 100 Crown St. (Res. 785 Edgewood Ave.), New Haven, Conn. ....M. Aug. 10, 1904

ALBERT D. BLAKESLEE. Superintendent, with C. W. Blakeslee & Sons, 58 Waverly St. (Res. 100 Dwight St.), New Haven, Conn. (*Assoc. M., Aug. 8, 1910*) ....M. Feb. 19, 1918

CLARENCE BLAKESLEE. Civil Engineer and Contractor, C. W. Blakeslee & Sons, 58 Waverly St., New Haven, Conn. ....M. Jan. 9, 1900

HAROLD L. BLAKESLEE. With C. W. Blakeslee & Sons, 58 Waverly St. (Res. 239 McKinley Ave.), New Haven, Conn....M. Feb. 11, 1913

MILES GRANT BLAKESLEE. With C. W. Blakeslee & Sons, 58 Waverly St. (Res. 501 George St.), New Haven, Conn. .....M. Feb. 19, 1918

WILLIAM J. BLATCHLEY. Civil Engineer, with V. B. Clarke, Ansonia, Conn. (Res. 131 East Grand Ave., New Haven, Conn.) ....M. Aug. 10, 1904

CLARENCE E. BLOOM. Clerk of Work, New Britain Hospital, New Britain, Conn. (Res. 469 Prospect Ave., Hartford, Conn.) M. Aug. 11, 1920

WILLIAM M. BOLTON. Civil Engineer, Room 18, City Hall (Res. 401 Ellsworth Ave.), New Haven, Conn. ....M. Aug. 12, 1915

DAVID BONNER, JR. Supt. of Construction, with Henry Steers, Inc., 17 Battery Pl., New York City (Res. Rye, N. Y.) ......M. Aug. 14, 1923

ARTHUR G. BOUTON. Sales Engineer, Barrett Co., 40 Rector St., New York City (Res. 146 Fairfield Beach, Fairfield, Conn.) ..M. Aug. 14, 1923

J. FRANK BOWEN. City Engineer, Manchester, Conn. (Res. 570 Woodbridge St., South Manchester, Conn.) ....M. Feb. 14, 1911

CHARLES A. BOWMAN. Civil Engineer, Room 18, City Hall (Res. 705 Dixwell Ave.), New Haven, Conn. ....M. Feb. 15, 1921

JAMES E. BOYLAN. Contracting Engineer, The Berlin Construction Co., Inc., Berlin, Conn. (Res. Middletown, Conn.)......M. Feb. 14, 1912

Br

JOHN J. BRADY. Civil Engineer, 60 Laurel St., Waterbury, Conn. ....M. Feb. 21, 1922

FRANK S. BRAINARD. Asst. Engineer, Distribution Division, Hartford Waterworks (Res. 246 Palm St.), Hartford, Conn...M. Aug. 9, 1921

WILLIAM H. BRAINARD. City Engineer's Office (Res. 99 Westland St.), Hartford, Conn. ....M. Feb. 21, 1923

REUBEN J. BRENNER. Civil Engineer and General Insurance, 39 Church St. (Res. 24 Cassius St.), New Haven, Conn. ....M. Feb. 17, 1920

WILLARD S. BREWER. Division Engineer, City Engineer's Office (Res. 25 Salem St.), Hartford, Conn. ....M. Feb. 12, 1907

DANIEL E. BRINSMADE. President and Treasurer, Ousatonic Water Co., P. O. Drawer O, Derby, Conn. ....M. April 20, 1901

CLEMENT M. BRODERICK. State Highway Dept., 12 Washington St. (Res. 30 Standish St.), Hartford, Conn. ....M. Feb. 17, 1920

JAMES T. BROSNAN. 24 East Pearl St., New Haven, Conn...M. Aug. 7, 1918

HENRY G. BROTHWELL. Civil Engineer, State Highway Dept., Torrington, Conn. ....M. Aug. 14, 1923

CHARLES B. BROWN. With The Frederick M. Ward Co., 53 Church St. (Res. 1470 Chapel St.), New Haven, Conn. ....M. Aug. 14, 1907

CHARLES O. BROWN. City Engineer, City Hall, Danbury, Conn. ....M. Jan. 11, 1898

RAYMOND J. BROWN. Field Engineer, Foamite-Childs Corp. (Res. 102 Mason Place), Utica, N. Y. ....M. Feb. 15, 1916

ROGER C. BROWN. Civil Engineer, with A. B. Hill, 100 Crown St. (Res. 132 Howe St.), New Haven, Conn. ....M. Aug. 14, 1923

GEORGE E. BROWNE. City Engineer's Office, Waterbury, Conn. (Res. Bantam, Conn.) ....M. Feb. 21, 1922

FRANK R. BRYANT. With Barber Asphalt Co., 1609 Woolworth Building, New York, N. Y. ....Assoc. M. Feb. 20, 1923

Bu

HENRY ROBINSON BUCK. President of Buck & Sheldon, Inc., Consulting Engineers, 60 Prospect St., Hartford, Conn. ....M. Jan. 10, 1899

CARLETON W. BUELL. President of Sperry & Buell, Inc., Bristol, Conn. ....M. July 25, 1922

ELLSWORTH BURGER. Representing The American Abrasive Metals Co., 50 Church St., New York City (Res. 47 Oakwood Ave., Rye, N. Y.) ....M. Aug. 11, 1922

HAROLD T. BURGESS. Civil Engineer, with C. W. Blakeslee & Sons, 58 Waverly St., New Haven, Conn. (Res. 201 South Fourth St., Meriden, Conn.) ....M. Feb. 15, 1916

WALLACE W. BURGHARDT. Civil Engineer, Canaan, Conn...M. Feb. 13, 1906

AARON BURROS. Civil Engineer, care of John Burros, 1772 East 19th St., Brooklyn, N. Y. ....M. Feb. 19, 1918

LUTHER HAROLD BURT. Sole partner, L. W. Burt & Son, Civil Engineers, 721 Main St. (Res. 38 Linnmoore St.), Hartford, Conn. ....M. Aug. 14, 1909

EMIL C. BUSCHOR. Asst. Engineer, Interborough R. T. Co., 165 Broadway, New York City (Res. 324 East Second Ave., Roselle, N. J.) ....M. Jan. 10, 1893

EDWARD W. BUSH. Engineer, Ætna Casualty & Surety Co. (Res. 137 North Whitney St.), Hartford, Conn. ....M. Jan. 10, 1899

ARTHUR W. BUSHELL. Division Engineer, State Highway Dept., Box 1748, New Haven, Conn. (Res. 24 Forest St., West Haven, Conn.) ....M. Feb. 20, 1917

HARRY B. BUSSING, JR. Cost Engineer, N. Y., N. H. & H. R. R., 150 Capitol Ave., Hartford, Conn. (Res. 12 Jefferson St., Norwalk, Conn.) ....M. Feb. 21, 1922

Ca

WILLIAM H. CADWELL. President, The Beaton & Cadwell Mfg. Co., P. O. Box 1012 (Res. 130 West Main St.), New Britain, Conn. ....M. May 31, 1893

ALEXANDER CAHN. Civil Engineer, 839 Chapel St. (Res. 188 Livingston St.), New Haven, Conn. ....M. Jan. 9, 1900

ROBERT A. CAIRNS. City Engineer, City Hall (Res. 100 Central Ave.), Waterbury, Conn. ....M. Aug. 29, 1890

FRED E. CALDWELL. Portland Cement Association, Chicago, Ill. (Res. 67 Midland Ave., East Orange, N. J.) ....M. Feb. 17, 1920

CARROL A. CAMPBELL. Supt. Meech & Stoddard, Inc., 46 North Main St. (Res. 148 Lincoln St.), Middletown, Conn. ....M. Feb. 9, 1909

DANA H. CANNON. Secretary and Treasurer, The Industrial Construction Co., 721 Main St., Hartford, Conn. ....M. Feb. 17, 1920

WILFRED J. CAREW. Timber Agent, Connecticut Co., 129 Church St., New Haven, Conn. ....M. Aug. 14, 1923

FRANK J. CAREY. The Larkin-Carey Co., 166 Brewery St., New Haven, Conn. ....Assoc. M. July 25, 1922

H. E. CARLISLE. Conduit Engineer, Southern New England Tel. Co., New Haven, Conn. ....M. Jan. 9, 1900

LAURANCE J. CARMALT. Consulting Engineer, 129 Church St. (Res. 261 St. Ronan St.), New Haven, Conn. ....M. Feb. 19, 1918

ROBERT N. R. CHAFFEE. Civil Engineer, Meriden, Conn. ...M. Aug. 15, 1916

CHARLES H. CHAPMAN. Manager, The Connecticut Co. P. O. Box 1124, Waterbury, Conn. (Res. Cheshire, Conn.) ..Assoc. M. Feb. 15, 1916

CHARLES F. CHASE. Chief Engineer, The Berlin Construction Co., Inc., Berlin, Conn. (Res. 241 West Main St., New Britain, Conn.) ....M. Mar. 30, 1900

JONATHAN H. CHILD. Superintendent of Construction, R. Wallace & Sons Mfg. Co. (Res. 91 North Main St.), Wallingford, Conn. ....M. Aug. 9, 1921

ERNEST H. D. CHRISTOFFERSON. City Engineer's Office (Res. 44 Stewart Ave.), Waterbury, Conn. ....M. Aug. 14, 1923

Cl

ALBERT L. CLARK. Draftsman, The Connecticut Co., 129 Church St. (Res. 181 West Rock Ave.), New Haven, Conn. ....M. Feb. 17, 1920

HERBERT G. CLARK. Asst. Engineer, City Engineer's Office (Res. 4 West Clay St.), Hartford, Conn. ....M. July 18, 1899

JAY H. F. CLARK. Asst. Engineer, The Connecticut Co., 129 Church St., New Haven, Conn. (Res. Madison, Conn.) ....M. Feb. 17, 1920

ROBERT W. CLARK. President, Clark Construction Co., 168 Grand St. (Res. 12 Sterling St.), Waterbury, Conn. ....M. Feb. 21, 1922

ROSCOE N. CLARK. City Engineer, Hartford, Conn. ....M. July 18, 1899

WILLIAM S. CLARK. Civil Engineer, The York Hill Trap Rock Quarry Co., State and Broad Sts., Meriden, Conn. ....M. July 14, 1890

STANLEY N. CLARKE. With W. H. Arthur, Stamford, Conn. (Res. Darien, Conn.) ....M. Aug. 16, 1911

VINCENT B. CLARKE. Consulting Engineer, Capitol Bldg. (Res. 244 Wakelee Ave.), Ansonia, Conn. ....M. Feb. 9, 1904

WALDO E. CLARKE. Superintendent of State Pier (Res. 891 Montauk Ave.), New London, Conn. ....M. Feb. 10, 1914

CHAUNCEY H. CLEMENTS. Cable Supervisor, Southern New England Telephone Co. (Res. 25 Irving St.), New Haven, Conn. ....M. Aug. 9, 1921

WILLIAM A. CLINTON. Steel Fabrication & Erection, 127 Sargent St., Hartford, Conn. ....M. Aug. 9, 1921

F. PERRY CLOSE. Division Engineer, City Engineer's Office (Res. 39 Eastview St.), Hartford, Conn. ....M. Feb. 19, 1918

EARL E. CLOUGH. Connecticut National Pavements, Inc., 109 Court St., New Haven, Conn. ....M. Aug. 9, 1921

Co

ALFRED H. CODAIRE. Collinsville, Conn. ....M. Feb. 15, 1916

FREDERICK L. COE. Park Engineer, City Hall (Res. 122 Howe St.), New Haven, Conn. ....M. Feb. 14, 1911

THEODORE I. COE. Architect, 342 Madison Ave., New York City (Res. 170 Elm St., New Rochelle, N. Y.) ....M. Jan. 9, 1900

WALTER E. COLBY. Civil Engineer, 69 Branch St., Waterbury, Conn. ....M. Feb. 21, 1922

CLINTON L. COLE. Bliss & Cole, Appraisers, Connecticut Mutual Bldg., Hartford, Conn. ....M. Feb. 9, 1904

ALFRED P. COLGAN. Civil Engineer, 44 Beacon St., Waterbury, Conn. ....M. Feb. 9, 1915

EDWARD T. COLLINS. U. S. Inspector, Engineering Dept., 298 Huntington St., New London, Conn. ....M. Feb. 11, 1913

HARRY C. COLLINS. With The Berlin Construction Co., Inc., 25 Sanford St. (Res. 240 Washington Boulevard), Springfield, Mass. ....M. July 18, 1899

JOHN F. COLLINS. City Engineer's Office (Res. 195 Jackson St.), Willimantic, Conn. ....M. July 25, 1922

ALLAN D. COLVIN. General Manager, The Hartford Electric Light Co., 266 Pearl St. (Res. 280 Edgewood St.), Hartford, Conn. ....M. Feb. 21, 1922

LEWIS B. COMSTOCK. Civil Engineer, Comstock Block, East Hartford, Conn. ....M. Aug. 10, 1904

JOSEPH W. CONE. Civil Engineer, with S. E. Minor & Co., P. O. Box 562, Greenwich, Conn. ....M. Aug. 12, 1908

HAROLD M. CONNELLY. State Highway Dept., 769 Wethersfield Ave., Hartford, Conn. ....M. Feb. 17, 1920

M. A. CONNOR. Connor & Poriss, General Contractors, 54 Church St., Hartford, Conn. ....M. Feb. 14, 1911

CHARLES W. COOKE. City Engineer's Office (Res. 9 Madison St.), Hartford, Conn. ....M. Feb. 21, 1922

Cr

JAMES CRAIG. Asst. Division Engineer, State Highway Commission, 12 Washington St., Hartford, Conn. (Res. Elmwood, Conn.) ....M. Feb. 18, 1919

ROY C. CRAM. Engineer of Surface Roadway, Brooklyn-Manhattan Transit Corp., 85 Clinton St. (Res. 115 Woodruff Ave.), Brooklyn, N. Y. ....M. Feb. 8, 1910

GEORGE K. CRANDALL. Civil Engineer, 154 State St., New London, Conn. ....M. Jan. 11, 1887

ERNEST W. CRAWLEY. Assistant U. S. Engineer, Federal Bldg., Providence, R. I. (Res. East Greenwich, R. I.) ....M. Feb. 14, 1912

ROBERT ELLIS CROSS. City Engineer's Office (Res. 11 Shultas Place), Hartford, Conn. ....M. Feb. 15, 1916

TRUMAN M. CURRY, JR. Civil Engineer, with Hugh L. Thompson, Consulting Engineer, 57 North Main St. (Res. 78 Chestnut Ave.), Waterbury, Conn. ....M. Feb. 21, 1922

ABNER L. CURTIS. Construction Engineer, N. Y., N. H. & H. R. R. Co., New Haven, Conn. (Res. 85 Mather St., Whitneyville, Conn.) ....M. Feb. 14, 1912

CHARLES D. CURTIS. Civil Engineer, 98 Church St., Naugatuck, Conn. ....M. Aug. 17, 1909

FAYETTE S. CURTIS. Vice President, N. Y., N. H. & H. R. R. Co., Boston, Mass. .... M. Jan. 9, 1906

R. ELMER CURTISS. Curtiss & Dean, 721 Main St., Hartford, Conn. .... M. Feb. 20, 1923

D

ERNEST C. DABOLL. Civil Engineer, Groton, Conn. .... M. Feb. 14, 1911

LOREN E. DABOLL. Civil Engineer, 98 State St., P. O. Box 356, New London, Conn. .... M. Jan. 8, 1895

HARRY E. DAGGETT. Civil Engineer, Hall & Lewis Bldg., Meriden, Conn. (Res. 175 Benton St., Hartford, Conn.) .... M. Aug. 9, 1921

EDWARD L. DARGAN. State Highway Department, 446 Beechwood Ave., Bridgeport, Conn. .... M. Feb. 18, 1910

COURTLAND R. DARROW. Supt. of Streets, New London, Conn. (Res. Waterford, Conn.) .... M. Jan. 8, 1895

ARTHUR L. DAVIS. Division Manager, American Bridge Co., 71 Broadway, New York, N. Y. (Res. 276 Bedford Ave., Mt. Vernon, N. Y.) .... M. July 18, 1890

FRANK J. DAVIS. Superintendent and Secretary, Ansonia Water Co., 354 Main St. (Res. 51 Franklin St.), Ansonia, Conn. .... M. Feb. 14, 1911

LESTER S. DAY. Division Construction Foreman, S. N. E. Telephone Co., 41 Lake St., Hamden, Conn. .... M. July 25, 1922

GEORGE W. DEAN. Curtiss & Dean, 721 Main St., Hartford, Conn. .... M. Feb. 20, 1923

THOMAS DE FOREST. General Contractor, 320 North Ave., Bridgeport, Conn. .... Assoc. M. Aug. 14, 1923

JAMES F. DEGNAN. Secretary, C. A. Sibley Co., Contracting Engineer, 902 Chapel St., New Haven, Conn. .... Assoc. M. Feb. 17, 1920

WINFRED W. DE MAY. City Engineer's Office (Res. 186 Lawrence St.), Hartford, Conn. .... M. Feb. 17, 1920

CHARLES R. DEMING. 616 North Williams St., Dayton, Ohio..M. Feb. 20, 1917

FREDERICK DE PEYSTER. President, The Brainerd, Shaler & Hall Quarry Co., Portland, Conn. .... M. Sept. 3, 1891

ROYAL B. DOANE. Maple Hill, New Britain, Conn. .... M. Feb. 20, 1917

JOHN H. DOERR. Roadmaster, Connecticut Co. (Res. 129 Frost Road), Waterbury, Conn. .... M. Feb. 11, 1913

JOSEPH DOMAN. Asst. Sanitary Engineer, State Department of Health, 8 Washington St. (Res. 1642 Broad St.), Hartford, Conn. .... M. Feb. 21, 1922

EDWARD L. DONAGHUE. Civil Engineer's Office, Municipal Building, Hartford, Conn. .... M. Feb. 19, 1918

ALBERT L. DONNELLY. Division Engineer, The Connecticut Company, 185 Church St., New Haven, Conn. .... M. Feb. 14, 1912

JOHN F. DOONAN. Engineer, Rockville-Willimantic Lighting Co., Willimantic, Conn. .... M. Feb. 20, 1923

WILLIAM T. DORRANCE. Designing Engineer, N. Y., N. H. & H. R. R. Co., Railroad Building, New Haven, Conn. .... M. Feb. 17, 1920

JOSEPH M. DUFFY. 58 Dorchester Ave., Boston, Mass...Assoc. M. Feb. 17, 1920

W. R. DUNHAM, JR. Executive Engineer, Dept. of Street Railways, St. Jean and Shoemaker Sts., Detroit, Mich. (Res. 69 Stanley St., New Haven, Conn.) .... M. Feb. 12, 1907

HERBERT L. DUNN. With Merritt-Chapman & Scott Corp. (Res. 172 Willetts Ave.), New London, Conn. .... M. Aug. 14, 1914

E. F. DURFEE. Salesman, The Texas Co., 22 Hawthorne Ave., Providence, R. I. .... M. Aug. 14, 1923

E

FREDERICK J. EASTERBROOK. Civil Engineer (Res. 82 York Square), New Haven, Conn. .... M. Mar. 30, 1900

JOHN N. ECKLE. Instructor, Sheffield Scientific School, Yale University, 134 Winchester Hall, New Haven, Conn. (Res. 283 Union Ave., West Haven, Conn.) ....M. Feb. 9, 1915

CHARLES W. EDDY. Asst. Engineer, Waterbury Water Supply, City Engineer's Office, P. O. Box 244, Thomaston, Conn......M. Jan. 9, 1900

FREDERICK H. EDWARDS. Engineer, Connecticut Quarries Co., 152 Temple St., New Haven, Conn. (P. O. Box 324, Meriden, Conn.) ....Assoc. M. July 25, 1922

F. H. ELLSWORTH. Division Engineer, N. Y., N. H. & H. R. R. Passenger Station (Res. 270 Sigourney St.), Hartford, Conn...M. Mar. 30, 1900

HERBERT C. ELTON. Civil Engineer, with A. H. Terry, Consulting Engineer, 886 Main St. (Res. 78 Rowsley St.), Bridgeport, Conn. ....M. Feb. 9, 1915

CHARLES CLEMENT ELWELL. Public Utilities Commission (Res. 71 College St.), New Haven, Conn. ....M. Feb. 8, 1910

WILLIAM J. ENNIS. Asst. Supervisor, Dept. of Building Inspection (Res. 309 Albany Ave.), Hartford, Conn. ....M. Aug. 9, 1921

DOMINICK B. EULA. City Engineer, City Hall (Res. 44 Spring St.), South Norwalk, Conn. ....M. Feb. 18, 1919

LAFAYETTE E. EVANS. State Highway Dept., 106 Elm St., New Haven, Conn. (Res. 665 Boston Ave., Bridgeport, Conn.) ...M. Feb. 14, 1911

EDWARD H. EVERIT. Chief Engineer, Southern New England Tel. Co. (Res. 25 Edgehill Terrace), New Haven, Conn. ....M. Oct. 11, 1902

F

CHARLES S. FARNHAM. Assistant Professor of Civil Engineering, Sheffield Scientific School (Res. 211 Norton St.), New Haven, Conn. ....M. Feb. 9, 1904

CHARLES A. FERRY. Consulting Engineer, 82 Church St., New Haven, Conn. ....M. Jan. 9, 1900

AARON FIEN. City Engineer's Office, Junior Asst. Engineer (Res. 87 Portland St.), Hartford, Conn. ....M. Feb. 17, 1920

WILLIAM H. FITTZELL. Purchasing and Erection Work, Berlin Construction Co., Berlin, Conn. (Res. 87 Sefton Drive, New Britain, Conn.) ....Assoc. M. Feb. 15, 1921

EDWARD P. FITZGERALD. Inspector, Construction Engineering Dept., The Connecticut Co. (Res. 428 Fountain St.), New Haven, Conn. ....M. Feb. 20, 1923

FRANK G. FLOOD. Chemist, Municipal Building, Hartford, Conn. ....M. Feb. 20, 1923

WILLIAM A. FONES. Resident Vice President, The Merritt-Chapman & Scott Corp., 172 Willetts Ave., New London, Conn. ....Assoc. M. Aug. 11, 1920

FREDERICK L. FORD. President and Treasurer, Ford Bros., Inc., General Contractors, 412-458 Quinnipiac Ave. (Res. 140 Cottage St.), New Haven, Conn. ....M. Jan. 12, 1897

GEORGE S. FRANCIS. Civil Engineer, City Engineer's Office, Hartford, Conn. (Res. 224 Nott St., Wethersfield, Conn.) ....M. Feb. 19, 1918

JOHN L. FRECH. Civil Engineer, N. Y., N. H. & H. R. R., New Haven, Conn. (Res. 17 Smith St., West Haven, Conn.) ......M. Feb. 20, 1917

JOSEPH H. FRENCH. Electrical Engineer, The Eastern Power Co., 362 Main St., (Res. 112 Orchard St.), Norwich, Conn....M. Feb. 17, 1920

HOWARD W. FRITZ. City Engineer's Office, Waterbury, Conn. ....Assoc. M. Feb. 21, 1922

WILLIAM J. FRITZ. With Mascetti & Holley, Contractors (Res. 33 Grove St.), Torrington, Conn. ....M. Feb. [illegible], 1923

AUBREY D. FULLER. Scofield & Ford, Civil Engineers, 952 Main St., Bridgeport, Conn. ....M. Feb. 17, [illegible]

G

ROBERT F. GADD. Estimator, Engineer, Salesman and General Manager, Levering & Garrigues Co. (Res. 76 Kenyon St.), Hartford, Conn. ....M. Feb. 17, 1920

EDWARD GAGEL. Chief Engineer, N. Y., N. H. & H. R. R. Co., New Haven, Conn. ....M. Jan. 9, 1900

CHESTER F. GAILOR. Consulting Engineer, 30 Church St., New York, N. Y. ....M. Feb. 15, 1916

D. FLOYD GAILOR. Civil Engineer, with The Connecticut Co., 185 Church St. (Res. 511 Whalley Ave.), New Haven, Conn....M. Feb. 11, 1913

ROBERT S. GARDNER. Wreckmaster, The Merritt-Chapman & Scott Corp., New London, Conn. ....M. Aug. 11, 1920

GEORGE M. GEARHART. Track Dept., Connecticut Co. (Res. 137 Wooster St.), New Britain, Conn. ....M. Feb. 20, 1923

E. SELDEN GEER. Compensation and Liability Underwriter, The Travelers Insurance Co., 700 Main St. (Res. 64 Niles St.), Hartford, Conn. ....M. Feb. 15, 1916

L. NORMAN GERMAIN. Dept. of Public Works, Municipal Bldg. (Res. 165 Pearl St.), Middletown, Conn. ....M. Aug. 14, 1923

CHARLES F. GIFFORD. Architect, East Hartford, Conn. ....M. Aug. 9, 1921

WILLIAM T. GILBERT. Superintendent, C. W. Blakeslee & Sons, 58 Waverly St. (Res. 170 McKinley Ave.), New Haven, Conn..M. Feb. 17, 1920

OLIVER GILDERSLEEVE. Superintendent, The Gildersleeve Ship Construction Co., Gildersleeve, Conn. ....M. Aug. 9, 1921

COSTANTE A. GIORDANO. Civil Engineer, Room 18, City Hall (Res. 88 Wooster St.), New Haven, Conn. ....M. Feb. 20, 1923

HENRY H. GLADDING. Assistant City Engineer, City Hall, New Haven, Conn. ....M. Jan. 9, 1900

EDWARD O. GOSS. Asst. Treasurer, Scovill Mfg. Co., 117 Pine St., Waterbury, Conn. ....M. Nov. 20, 1890

EDWIN D. GRAVES. Civil Engineer, Hartford, Conn. ....M. Oct. 25, 1895

CARL E. GREEN. Vice President, The R. G. Bent Co., 183 Ann St. (Res. 154 North Whitney St.), Hartford, Conn. ....M. Aug. 14, 1923

WALTER P. GREEN. Structural Draftsman, The American Brass Co. (Res. 15 Plank Road), Waterbury, Conn. ....M. Feb. 19, 1918

ALBERT H. GREENWOOD. Greenwood & Noerr, Consulting Engineers, 847 Main St., Hartford, Conn. ....M. Feb. 9, 1904

J. LOUIS GREGORY. Supt. McGregor Links, Box 297, Saratoga Springs, N. Y. (Res. 5 Lake Ave., Greenwich, Conn.) ....M. Aug. 10, 1904

LOUIS EVERETT GUYOTT. Construction Engineer, Conn. National Pavements, Inc., 194 Peck Ave., West Haven, Conn..M. Feb. 18, 1919

Ha

CHARLES ERNEST HALL. Civil Engineer, Third Ave. Railway Co., 2396 Third Ave., New York, N. Y. ....M. Feb. 12, 1907

WILLIAM H. HALL. Civil Engineer and Contractor, P. O. Box 280, New Britain, Conn. ....M. Feb. 12, 1907

WILLIAM HALTON. Amiesite, Contractor, 153 Stevens Ave., Mt. Vernon, N. Y. ....Assoc. M. Aug. 7, 1918

GEORGE C. HAM. Civil Engineer, 98 Church St., Naugatuck, Conn. ....M. Aug. 17, 1909

CHARLES B. HAMILL. Warner Brothers (Res. 7 Marne Ave.), Bridgeport, Conn. ....M. Feb. 18, 1919

GEORGE E. HAMLIN. Superintendent of Repairs, State Highway Dept., 12 Washington St. (Res. 293 Grandview Terrace), Hartford, Conn. ....M. Aug. 12, 1915

CLINTON D. HANOVER, JR. Civil Engineer, with E. W. Wiggin, 113 Church St., New Haven, Conn. ....M. Feb. 20, 1923

ALEXANDER JOSEPH HANS. Chief Engineer, Piping Rock Estates, Locust Valley, Long Island, N. Y. ....M. Feb. 12, 1907

IRVING W. HARRISON. Supt. of Parks, City Hall (Res. 29 Kenilworth St.), Waterbury, Conn. ....M. Feb. 20, 1923

JONATHAN T. HART. Superintendent, Berlin Construction Co., Berlin, Conn. ....M. Feb. 15, 1916

CHARLES RUFUS HARTE. Construction Engineer, The Connecticut Co., 129 Church St., New Haven, Conn. ....M. Aug. 10, 1904

FREDERICK B. HASTINGS. Contractor, Wood Ave., Bridgeport, Conn. ....Assoc. M. Feb. 10, 1903

CHARLES A. HATCH. Vice President and General Manager, Stamford Water Co., Stamford, Conn. ....Assoc. M. Aug. 14, 1923

RALPH DE W. HAVEN. Civil Engineer, 245 East Ave., East Norwalk, Conn. ....M. Feb. 8, 1910

ARTHUR S. HAWLEY. The Bradley-Smith Co., Wholesale Confectioners (Res. 193 Maple St.), New Haven, Conn. ....M. Feb. 11, 1902

He

ORRIN W. HEAD. Supt. of Streets, City Hall (Res. 81 North Spring St.), Concord, N. H. ....M. Feb. 15, 1916

GUSTAV A. HELLWIG. Asst. Engineer, N. Y., N. H. & H. R. R., Real Estate Dept., New Haven, Conn. (Res. 306 Capitol Ave., Bridgeport, Conn.) ....M. Feb. 17, 1920

JOHN T. HENDERSON. Chief Engineer, Connecticut River Bridge and Highway District, 756 Main St., Hartford, Conn. ....M. July 18, 1899

JAMES H. HENDRY. Civil Engineer, Hartford Electric Light Co. (Res. 90½ Brook St.), Hartford, Conn. ....M. Feb. 21, 1923

ABRAM W. HERBST. General Manager, The New England Slag Co., Canaan, Conn. ....Assoc. M. Aug. 7, 1918

CHARLES W. HEUSTED. The Berlin Construction Co., Berlin, Conn. (Res. 126 Warrenton Ave., Hartford, Conn.) ...Assoc. M. Feb. 17, 1920

WILLIAM S. HEWLETT. Treasurer, The Hewlett Co., Builders, 886 Main St. (Res. 98 Ashley St.), Bridgeport, Conn. ..Assoc. M. Feb. 20, 1917

WILLIAM F. HICKEY. Carnegie Steel Co., P. O. Box 333, Boston, Mass. ....Assoc. M. Feb. 9, 1909

ALBERT B. HILL. Consulting Engineer, 100 Crown St., P. O. Box 549, New Haven, Conn. ....M. Jan. 9, 1900

EMIL L. G. HOHENTHAL, JR. General Contractor, Roosevelt St. (Res. 33 Ridgewood St.), South Manchester, Conn. ....M. Aug. 13, 1913

C. G. HAROLD HOLBROOK. Civil Engineer, with C. W. Blakeslee & Sons, 58 Waverly St. (Res. 471 Central Ave.), New Haven, Conn. ....M. Feb. 13, 1912

JOSEPH W. HOLDEN. Town Engineer, Town Building (Res. 87 Vera St.), West Hartford, Conn. ....M. Feb. 20, 1923

IRVING B. HOLLEY. General Contracting, 45 Holley St., Torrington, Conn. ....Assoc. M. Feb. 17, 1920

EBEN C. HOLLIS. 36 Silver St., Waterbury, Conn. ....M. Feb. 19, 1918

ROBERT M. HOSLEY. Asst. Engineer, N. Y., N. H. & H. R. R. (Res. 304 Ferry St.), New Haven, Conn. ....M. Aug. 23, 1905

FRANK W. HOWARD. Portland Construction Co., 52 Exchange St., Portland, Me. (Res. 643 Central Ave., Bridgeport, Conn.)..M. Feb. 17, 1920

SAMUEL W. HOYT, JR. Civil Engineer, 34 Washington St., South Norwalk, Conn. ....M. Feb. 9, 1904

CHARLES E. HUBBARD. 160-170 Front St., Hartford, Conn. ....Assoc. M. Aug. 17, 1909

WILLIAM H. HULL. Civil Engineer, The Merritt-Chapman & Scott Corp. (Res. 333 Ocean Ave.), New London, Conn. .....M. Aug. 11, 1914

FRANK J. HURLEY. Sewer and Plumbing Inspector, 511 Main St., Southington, Conn. ....M. Aug. 14, 1923

HOWARD G. HUSTED. Asst. Engineer, New Haven Gas Light Co., 80 Crown St., New Haven, Conn. (Res. 455 Second Ave., West Haven, Conn.) ....M. Feb. 21, 1922

HENRY N. HYMEN. 223 North Rosemont Ave., Los Angeles, Cal. ....M. Aug. 11, 1920

I

HOLLIS D. IMMICK. President, The Immick Co., 240 East Main St. (Res. Bradley Park), Meriden, Conn. ....M. Aug. 9, 1921

FRANK INESON. Civil Engineer, Scovill Mfg. Co. (Res. 310 Lincoln St.), Waterbury, Conn. ....M. Feb. 19, 1918

REGINALD G. INGE. 177 Westminster St., Springfield, Mass. ....Assoc. M. Feb. 17, 1920

J

J. FREDERICK JACKSON. Consulting Engineer, 185 Church St., New Haven, Conn., also Director of Bureau of Sanitary Engineering, State Department of Health, Hartford, Conn. ....M. Jan. 9, 1900

FRANK B. JAYNES. F. B. Jaynes, Inc., 201 Watson Building, Bridgeport, Conn. ....M. Feb. 10, 1903

CARL V. JOHNSON. With Buck & Sheldon, Inc., Consulting Engineers (Res. 185 Bond St.), Hartford, Conn. ....M. Aug. 9, 1921

FREDERICK H. JOHNSON. 63 Connecticut Ave., New Britain, Conn. ....M. Feb. 18, 1919

JAMES F. JOHNSON. With Clark, Hall & Peck, Title Searchers, New Haven, Conn. (Res. 1119 Central Ave., Bridgeport, Conn.) ....M. Feb. 17, 1920

WILLIAM D. JOHNSON. Manager, The Wm. D. Johnson Co., 174 Bond St., Hartford, Conn. ....M. Aug. 14, 1900

WILLIAM E. JOHNSON. Division Engineer, Water Dept., Hartford (Res. West Hartford, Conn.) ....M. Nov. 29, 1890

MERWIN M. JOHNSTON. Civil Engineer, The Connecticut Co., 185 Church St. (Res. 191 Alden Ave.), New Haven, Conn....M. Aug. 8, 1917

WALTER A. JONES. Central Pennsylvania Coal Producers' Ass'n, Lincoln Trust Bldg., Altoona, Pa. ....M. Feb. 10, 1903

WALTER M. JONES. Civil Engineer, 5 Wellsville Ave., New Milford, Conn. (*Assoc. M. Feb. 15, 1916*) ....M. Feb. 17, 1920

K

GILES B. KEENY. Supt. of Public Works, P. O. Box 147 (Res. Rockville House), Rockville, Conn. ....M. Feb. 20, 1923

HERBERT C. KEITH. Consulting Engineer, 15 Park Row, New York, N. Y. (Res. 1815 Ditmas Ave., Brooklyn, N. Y.) ....M. Jan. 9, 1900

RAYMOND E. KELLEY. Civil Engineer, The J. H. Ellison Construction Co., 17 Forest St., Hartford, Conn. ....M. Feb. 15, 1916

JOSEPH O. KELLY. Supt., with C. W. Blakeslee & Sons, 58 Waverly St., New Haven, Conn. (Res. Stevenson, Conn.) ...M. Feb. 20, 1923

P. JAMES KELLY. The Connecticut Quarries Co. (Res. 100 Pendleton St.), New Haven, Conn. ....Assoc. M. Feb. 17, 1920

DENNIS A. KENNEDY. 715 Tremont Building, Boston, Mass. ....Assoc. M. Aug. 13, 1913

GILBERT R. KENT. Civil Engineer, N. Y., N. H. & H. R. R., New Haven, Conn. (Res. 71 Smith St., West Haven, Conn.) ....M. Aug. 16, 1910

HERBERT W. KENYON. U. S. Engineer, River and Harbor Work, 121 Calhoun Place, Bridgeport, Conn. ....M. Feb. 17, 1920

JOHN J. KERR. Sales Engineer, Lakewood Engineering Co., Cleveland, Ohio (Res. Valatie, N. Y.) ....Assoc. M. Aug. 11, 1920

CHARLES C. KILBY. C. C. Kilby, Inc., General Contractors, 116 Canterbury St., Hartford, Conn. ....M. Feb. 14, 1912

PAUL P. KIMBALL. City Engineer's Office (Res. 52 Madison St.), Hartford, Conn. ....M. Feb. 17, 1920

RICHARD SHELTON KIRBY. Assoc. Professor of Engineering Drawing, Yale University (Res. 165 Alden Ave.), New Haven, Conn. ....M. Mar. 30, 1900

RALPH B. KIRCHBERGER. City Engineer's Office, Waterbury, Conn. R. F. D. No. 1, Thomaston, Conn. ....M. Feb. 21, 1922

GEORGE A. KNIGHT. The Collins Co., Collinsville, Conn. ....M. Feb. 15, 1921

CHESTER A. KNOX. Designing and Mapping Track Layouts, N. Y., N. H. & H. R. R., New Haven, Conn. (Res. Madison, Conn.) ....M. Feb. 17, 1920

WILLIAM C. KRUSER. With American Brass Co. (Res. 54 New Litchfield St.), Torrington, Conn. ....M. Aug. 14, 1923

L

E. LE ROY LANE. Treasurer, Old Colony Crushed Stone Co., Quincy, Mass. (Res. Hingham, Mass.) ....M. Jan. 8, 1901

JOHN J. LANE. Director of Public Works, P. O. Box 733, New Haven, Conn. ....Assoc. M. Feb. 17, 1920

FREDERICK S. LANGDON. Secretary and Treasurer, Bilderbeck & Langdon, Architects and Engineers, Barrows Building, New London, Conn. ....M. Aug. 11, 1920

JAMES M. LANNAN. Asst. Director of Public Works, 207 Williams St., Middletown, Conn. ....M. Feb. 15, 1921

HAROLD D. LARRABEE. General Manager, The Eastern Connecticut Power Co., Norwich, Conn. (Res. 55 East Town St., Norwichtown, Conn.) ....M. Feb. 17, 1920

JOHN H. LAUPER. City Engineer's Office (Res. 16 Albion St.), Waterbury, Conn. ....M. Feb. 21, 1922

PHILIP G. LAURSON. Asst. Prof. of Engineering Mechanics, Yale University. 37 King St., Whitneyville, Conn. ....M. Feb. 21, 1922

WALTER H. LAW. Civil Engineer, 158 Cypress St., Providence, R. I. ....M. Aug. 10, 1904

EDWARD STANLEY LAWLER. State Highway Department, New Milford, Conn. ....M. Feb. 18, 1919

KENNETH W. LEIGHTON. Civil Engineer, 82 Church St. (Res. 372 Edgewood Ave.), New Haven, Conn. ....M. Feb. 14, 1911

GEORGE B. LEWIS. Civil Engineer, North Haven, Conn. ....M. Aug. 11, 1920

MERTON B. LEWIS, JR. Superintendent, The H. Wales Lines Co., Meriden, Conn. (Res. 7 Walnut St., Westerly, R. I.) ....M. Feb. 17, 1920

CLAYTON H. LINDSEY. Town Engineer's Office, Hamden, Conn. (Res. 619 Winchester Ave., New Haven, Conn.) ....M. Feb. 20, 1923

DOUGLAS G. LITTLE. Surveyor, City Engineer's Office (Res. 1054 West Main St.), Waterbury, Conn. ....M. Feb. 21, 1922

ELBERT E. LOCHRIDGE. Chief Engineer, Water Works, P. O. Box 1238, Springfield, Mass. ....M. Aug. 23, 1905

BRONSON E. LOCKWOOD. Civil Engineer, Watertown, Conn. .M. Feb. 21, 1922

D. CARL LOEWE. Division Engineer, State Highway Dept., P. O. Box 179, Winsted, Conn. ....M. Feb. 15, 1921

EDWIN H. LOTZ. MacKenzie & Lotz, Civil Engineers, 102 Center St. (Res. 17 Center Place), Southington, Conn. ....M. Feb. 15, 1921

HENRY E. LYLES. Connecticut Power Co., Canaan, Conn. ....M. Feb. 17, 1920

ALEXANDER S. LYNCH. Engineer and Designer of Amusement Parks, 228 Park St., West Haven, Conn. ....M. Aug. 14, 1907

C. TYLER LYON. Asst. Engineer, N. Y., N. H. & H. R. R. (Res. 416 Dixwell Ave.), New Haven, Conn. ....M. Feb. 17, 1920

Ma

JOHN A. MACDONALD. State Highway Commissioner (Res. 164 White St.), Hartford, Conn. ....M. Feb. 18, 1919

A. MAXWELL MACKENZIE. 1399 State St., Salem, Ore. ......M. Aug. 7, 1918

SAMUEL H. MACKENZIE. Engineer and Supt., Water Dept., Southington & Terryville Water Co., 102 Center St., P. O. Box 446, Southington, Conn. ....M. Feb. 9, 1915

WILLIAM A. MACKENZIE. Borough Engineer and Supt. of Water Department (Res. 390 North Main St.), Wallingford, Conn...M. Aug. 11, 1914

WILLIAM P. MACKENZIE. Asst. Engineer, N. Y., N. H. & H. R. R. (Res. 1251 Quinnipiac Ave.), New Haven, Conn........M. Feb. 17, 1920

GEORGE H. MACLEAN. Treasurer, The Sperry Engineering Co., 136 Chapel St. (Res. 56 Brownell St.), New Haven, Conn.....M. Feb. 9, 1904

G. VINCENT MACONI. Estimating Engineer, The Dwight Building Co., New Haven (Res. 462 Second Ave., West Haven, Conn.) ....M. Feb. 17, 1920

C. A. MAGILL. General Manager, Connecticut Hassam Paving Co., P. O. Box 230 (Res. 248 Willow St.), New Haven, Conn.....M. Aug. 14, 1907

E. PERRY MANVILLE. 143 North Whitney St., Hartford, Conn..M. Feb. 14, 1912

ORSON H. MARCHANT. Civil Engineer, with A. B. Hill, 100 Crown St. (Res. 241 Alden Ave.), New Haven, Conn. ....M. Feb. 14, 1905

CHARLES S. MASCHAL. Representing Standard Oil Co. of New York, Box 575 South Norwalk, Conn. (Res. 19½ Belden Ave., Norwalk, Conn.) ....Assoc. M. Feb. 20, 1923

ROBERT H. MATHER. Mechanical and Electrical Engineer, Buck & Sheldon, Inc., 60 Prospect St., Hartford, Conn. (Res. 51 Elm St., Windsor Locks, Conn.) ....M. Aug. 9, 1921

Mc

EDWARD A. McCARTHY. Re-valuation Engineer, Municipal Building, Middletown, Conn. (Res. 149 Black Rock Ave., New Britain, Conn.) ....M. Feb. 15, 1916

TIMOTHY D. McCARTHY. 42 Silver St., Waterbury, Conn. ....Assoc. M. July 30, 1919

TREVOR P. McCLUSKEY. Asst. Engineer, N. Y., N. H. & H. R. R. Co., New Haven, Conn. (Res. Connecticut Ave., Colonial Park, West Haven, Conn.) ....M. Feb. 17, 1920

HARVEY B. McCRONE. With Novelty Mfg. Co., Waterbury, Conn. P. O. Box 202, Watertown, Conn. ....M. Feb. 21, 1921

CHARLES E. McDONALD. 114 Benedict St., Waterbury, Conn..M. Feb. 14, 1912

GEORGE N. McDONALD. 35 Yates Ave., Waterbury, Conn.....M. Feb. 21, 1922

ALLEN McDOWELL. Civil Engineer, Kent, Conn. ....M. Feb. 17, 1920

EDWIN T. McDOWELL. Supt., Water Department, Middletown, Conn. ....M. Aug. 8, 1917

JAMES A. McELROY. City Engineer, City Hall (Res. 307 Golden Hill), Bridgeport, Conn. ....M. Feb. 9, 1909

HAROLD S. McINTOSH. Engineering Dept., N. Y., N. H. & H. R. R., No. 314 G. O. B., New Haven, Conn. (Res. 1099 Campbell Ave., West Haven, Conn.) ....M. Feb. 17, 1920

F. PAUL McKAIG. Civil Engineer, The Connecticut Co., Hartford, Conn. (Res. 38 Westland Ave., West Hartford, Conn.).......M. Aug. 11, 1914

THOMAS McKENZIE. Engineer and Supt., Water Department, Westerly, R. I. ....M. Feb. 12, 1907

JOHN T. McKNIGHT. Retired, Ellington, Conn. ....M. May 31, 1893

Me

REGINALD C. MEEKER. Transmission Engineer's Office, New England Telephone Co., Boston, Mass. ....M. Feb. 9, 1915

BERNARD A. MEHLS, JR. Civil Engineer, with A. B. Hill, 100 Crown St. (Res. 310 York St.), New Haven, Conn. ....M.	Feb. 15, 1921
PHILIP AMBROSE MERIAN. City Engineer's Office, New Britain, Conn. (Res. North Haven, Conn.) ....M.	Feb. 17, 1920
CHARLES W. MERRELS. Assistant Engineer, City Engineer's Office, New Haven, Conn. ....M.	Jan. 9, 1900
MALCOLM I. MERRITT. Secretary and Treasurer, Daly & Merritt, Inc., Contractors, 38 Broad St. (Res. 8 Rockland Ave.), Port Chester, N. Y. ....M.	Aug. 12, 1908
CHARLES J. MESSIER. Civil Engineer, with The C. A. Sibley Co., 902 Chapel St., New Haven, Conn. ....M.	Feb. 17, 1920
CLYDE A. MILLER. Coe Brass Co. (Res. 235 Riverside Ave.), Torrington, Conn. ....M.	Feb. 10, 1914
IRVING C. MILLER. Architect and Engineer, 175 Southmayd Road, Waterbury, Conn. ....M.	Feb. 19, 1918
RODNEY B. MILLER. Civil Engineer, Rollinsville, Colo. ......M.	Feb. 9, 1909
ARTHUR B. MILLS. With V. B. Clarke, Civil Engineer, Ansonia, Conn. (Box 91, Milford, Conn.) ....M.	Aug. 14, 1923
RICHARD I. MINNAMAN. Civil Engineer and Foreman of Construction, Scovill Mfg. Co. (Res. 29 Euclid Ave.), Waterbury, Conn. ....M.	Feb. 20, 1923
EDWARD E. MINOR. General Manager. New Haven Water Co., 91 Temple St., New Haven, Conn. (Res. P. O. Box 66, Mt. Carmel, Conn.) ....M.	Feb. 9, 1904
PIERPONT L. MINOR. Superintendent of Highways, Town Hall, (Res. 28 Ridge St.), Greenwich, Conn. ....M.	Feb. 11, 1913
SHELDON E. MINOR. Civil Engineer, S. E. Minor & Co., 96 Greenwich Ave., Greenwich, Conn. ....M.	Sept. 25, 1886
R. E. MITCHELL. City Engineer, 751 Main St., Willimantic, Conn. ....M.	Jan. 9, 1900
ALBERT F. MIX. Wreckmaster, The Merritt, Chapman & Scott Corp. (Res. 14 Perry St.), New London, Conn. ....M.	Aug. 11, 1920
FRANK J. MONAGHAN. Engineer, Waterbury Gas Light Co. (Res. 89 Ridgewood St.), Waterbury, Conn. ....M.	Feb. 21, 1922
ALLISON F. MOREHOUSE. Supt. of Building, 22 Church St. (Res. 14 Breckenridge Ave.), Meriden, Conn. ....Assoc. M.	Aug. 8, 1916
ERNEST B. MOSS. Civil Engineer, The H. Wales Lines Co. (Res. 235 Liberty St.), Meriden, Conn. ....M.	April 20, 1901
ARTHUR R. MOXTER. Supt. for Henry Steers, Inc., Contractor, 17 Battery Place, New York City (Res. R. F. D. No. 30, Stamford, Conn.) ....M.	Aug. 14, 1923
CLARENCE A. MUNSON. With New Haven Trap Rock Co., 67 Church St. (Res. 1426 Boulevard), New Haven, Conn. ....M.	Feb. 17, 1920
FRANK J. MURPHY. President, Bridgeport Dredge & Dock Co., 1024 Main St., Bridgeport, Conn. (Res. New York City) Assoc. M.	Feb. 15, 1921
HAROLD T. MURPHY. Supt., Grounds Dept., Eastern States Exposition (Res. 815 New Bridge St.), West Springfield, Mass. ....M.	Feb. 9, 1904
HENRY H. MURRAY. Electrical Engineer, 39 Boylston St., Boston, Mass. ....M.	Feb. 17, 1920
GEORGE L. MYLCHREEST. Designing Engineer, Buck & Sheldon, Inc. (Res. 238 Palm St.), Hartford, Conn. ....M.	Feb. 15, 1916
J. WARREN MYLCHREEST. Director of Public Works and Supt. of Water Works, Municipal Building (Res. 33 Brainerd Ave.), Middletown, Conn. ....M.	July 25, 1922

N

PAUL NASH. Construction Engineer, 434 Main St. (Res. 138 Glenbrook Road), Stamford, Conn. ....M.	Jan. 9, 1900

EDWARD S. NETTLETON. City Engineer, Room 18 City Hall (Res. 962 Townsend Ave.), New Haven, Conn. ....M. Feb. 17, 1920

THEODORE F. NEUHAUS. Civil Engineer, Buck & Sheldon, Inc., 60 Prospect St., Hartford, Conn. (Res. 120 Broad St., Windsor, Conn.) ....M. Feb. 15, 1921

LYNTON R. NEWHALL. Blast Engineer, Oakville Company, Waterbury, Conn. (Res. P. O. Box 360, Oakville, Conn.) ....M. Feb. 20, 1923

JAMES A. NEWLANDS. President, Henry Souther Engineering Co., 11 Laurel St., Hartford, Conn. ....M. Feb. 15, 1916

MORRIS B. NICHOLS. With V. B. Clarke, Capitol Building, Ansonia, Conn. (Res. 57 North St., Milford, Conn.) ....M. Feb. 18, 1919

HERBERT L. NICKELS. Engineer, Highway Construction, West Hartford, Conn. ....M. Feb. 18, 1919

C. H. NICKERSON. City Engineer, Torrington, Conn. ....M. July 25, 1922

WILLIAM F. NIERINTZ. Civil Engineer, with Williston Steel Co., 335 Main St., Torrington, Conn. ....M. Aug. 14, 1923

ROBERT COLLYER NOERR. Greenwood & Noerr, Consulting Engineers, 847 Main St., Hartford, Conn..............M. Feb. 12, 1907

O

C. HENRY OLMSTED. Civil Engineer, 1175 Main St., East Hartford, Conn. (Res. 745 Burnside Ave., Burnside, Conn.) .....M. July 18, 1899

HORACE B. OLMSTED. With Frank S. Sellew, Inc., Builders, 647 Main St., Hartford, Conn. (Res. 1100 Main St., East Hartford, Conn.) ....M. Feb. 20, 1917

GEORGE A. ORROK. Consulting Engineer, 17 Battery Place (Res. Irving Place and 15th St.), New York, N. Y. ....M. Feb. 9, 1909

H. SANFORD OSBORN. Osborn-Barnes Co., Contractors, Danbury, Conn. ....M. Aug. 14, 1923

P

SHEPARD B. PALMER. Chandler & Palmer, Civil Engineers, 161 Main St., Norwich, Conn. ....M. Jan. 8, 1895

GEORGE A. PARKER. Supt. of Parks, Municipal Building, Hartford, Conn. ....M. July 18, 1899

ROGER W. PARKHURST. The Barber Asphalt Paving Co., 1900 Land Title Building, Philadelphia, Pa. ....M. Aug. 9, 1921

HAROLD A. PARSONS. President, The Parsons Engineering Co., 49 Bank St. (Res. Revonah Manor), Stamford, Conn. ....M. Aug. 14, 1900

FREDERICK G. PATIENCE. Contracting Engineer, Berlin Construction Co., Berlin, Conn. (Res. 25 Plainfield St., Hartford. Conn.) ....M. Feb. 9, 1909

CHARLES A. PATTERSON. Civil Engineer, C. of C. Building (Res. Winsted Road), Torrington, Conn. ....M. Feb. 11, 1913

ARTHUR J. PATTON. Treasurer, The A. J. Patton Co., 27 West Main St. (Res. 153 Euclid Ave.), Waterbury, Conn. ....M. Sept. 12, 1889

MORRIS B. PAYNE. Architect and Civil Engineer, Manwaring Building (Res. 19 Alger Place), New London, Conn. ....M. Feb. 14, 1911

EDWARD J. PEARSON. President, N. Y., N. H. & H. R. R., 207 General Office Building, New Haven, Conn. ....M. Feb. 17, 1920

ERMON M. PECK. Civil Engineer, 647 Main St. (Res. 260 Edgewood St.), Hartford, Conn. ....M. Jan. 8, 1895

LEON F. PECK. Supt. of Street Department, Municipal Building (Res. 22 Montowese St.), Hartford, Conn. ....M. Oct. 11, 1902

GEORGE W. PENFIELD. Asst. Engineer, Hartford Water Works, Pilgard Bldg., Hartford, Conn. (Res. New Hartford, Conn.)..M. Jan. 8, 1901

LOUIS M. PETRUCELLI. Civil Engineer, Attorney-at-Law, Author, City Engineer's Office (Res. 267 Davenport Ave.), New Haven, Conn. ....M. Feb. 21, 1922

CLAIR M. PFENNIG. Treasurer, Sperry & Buell, Inc., 175 Main St. (Res. 129 Meadow St.), Bristol, Conn. ....M. Aug. 9, 1921

HOWARD E. PHELPS. Civil Engineer, with J. F. Jackson (Res. 118 Blake St.), New Haven, Conn. ....M. Aug. 8, 1917

JAMES W. PHELPS. Landscape Architect, Branford, Conn. ....M. Oct. 11, 1902

J. WARNE PHILLIPS. With Connecticut & Rhode Island Co., Inc., Contractors (Res. 30 Hobart St.), Meriden, Conn. ....M. Feb. 17, 1920

BRADFORD D. PIERCE, JR. President, The Connecticut Quarries Co., P. O. Drawer 1849, New Haven, Conn. (Res. Brooklawn Park, Bridgeport, Conn.) ....M. Aug. 23, 1905

FLOYD J. PITCHER. Asst. Engineer of Structures, N. Y., N. H. & H. R. R. (Res. 81 Woodbridge St.), New Haven, Conn. ...M. Feb. 20, 1917

EDWIN W. POLAND. Superintendent, C. W. Murdock Co., 505 Grand Ave., New Haven, Conn. ....M. Aug. 8, 1917

HARLAN D. POMEROY. City Engineer's Office (Res. 997 Maple Ave.), Hartford, Conn. ....M. Aug. 8, 1916

SOLOMON C. PORISS. Connor & Poriss (Res. 54 Oakland Terrace), Hartford, Conn. ....M. Aug. 13, 1913

C. PERRY PRANN. City Engineer, Meriden, Conn. ....M. Aug. 8, 1916

RAYMOND W. PRANN. Roadmaster, Connecticut Company, New Haven, Conn. ....M. Aug. 8, 1917

HUGH L. PRENTIS. Groton, Conn. ....M. Feb. 10, 1914

CHARLES H. PRESTON, JR. Architect and Engineer, 136 Grand St., Waterbury, Conn. ....M. Feb. 12, 1907

CHARLES E. PRICE. Member Highway Engineering Staff, Portland Cement Association, P. O. Box 1068 (Res. 340 Norton St.), New Haven, Conn. (*Assoc. M. July 30, 1919*) ....M. Feb. 17, 1920

JOHN K. PUNDERFORD. Vice President and General Manager, Connecticut Co., P. O. Box 1311, New Haven, Conn. ....M. Jan. 9, 1900

Q

JOHN P. QUAY. Structural Engineer, Berlin Construction Co., Berlin, Conn. (Res. 10 Camp St., New Britain, Conn.) ....M. Aug. 12, 1915

LOUIS F. QUIRK. Consulting Engineer, 279 Main St. (Res. 48 Home Ave.), Middletown, Conn. ....M. Feb. 21, 1922

R

JONATHAN S. RANDLE. Civil Engineer, with A. B. Hill, 100 Crown St. (Res. 227 Sherman Ave.), New Haven, Conn. .....M. Feb. 14, 1911

JOSEPH H. RAPUANO. Civil Engineer, Connecticut Co., 185 Church St. (Res. 592 Chapel St.), New Haven, Conn. ....M. Aug. 11, 1914

PETER K. RASK. Transitman, City Engineer's Office (Res. 710 Maple Ave.), Hartford, Conn. ....M. Feb. 15, 1916

LOUIS REED. Care of Aberthaw Construction Co., Boston, Mass..M. Feb. 15, 1921

MALVERN E. REID. Draftsman, State Highway Department, 12 Washington St. (Res. 48 Oak St.), Hartford, Conn. ....M. July 25, 1922

RAY J. REIGELUTH. With C. W. Blakeslee & Sons, 58 Waverly St. (Res. 179 Maple St.), New Haven, Conn. ....M. Feb. 20, 1923

ALFRED H. RICE. New Britain, Conn. ....Assoc. M. Feb. 18, 1919

RICHARD H. RICH. Asst. Engineer of Surveys, Real Estate Dept., N. Y., N. H. & H. R. R., No. 329 R. R. Bldg. (Res. 48 Goffe Terrace), New Haven, Conn. ....M. Aug. 11, 1914

CHARLES P. RICHMOND. Asst. Engineer, N. Y., N. H. & H. R. R., 164 West Main St., Waterbury, Conn. ....M. Feb. 21, 1922

HERBERT L. RIPLEY. Corporate and Valuation Engineer, N. Y., N. H. & H. R. R., South Station, Boston, Mass. (Res. 350 Chestnut St., Brockton, Mass.) ....M. Feb. 17, 1920

RALPH M. ROBINSON. Civil Engineer, The Connecticut Quarries Co., P. O. Box 1849, New Haven, Conn. ....M. Aug. 8, 1917

SEYMOUR N. ROBINSON. 145 Oxford St., Hartford, Conn....M. Feb. 9, 1904

WAYNE ROBISON. Robison & Powers, Inc., Meriden, Conn. Assoc. M. Aug. 7, 1918

CHARLES E. ROGERS. Professor of Civil Engineering, Trinity College (Res. 11 Lincoln St.), Hartford, Conn. ....M. Feb. 12, 1907

CHARLES A. ROOT. City Engineer's Office (Res. 53 Myrtle St.), Waterbury, Conn. ....M. Feb. 21, 1922

JUDSON B. ROOT. City Engineer's Office (Res. 217 Ashley St.), Hartford, Conn. ....M. Feb. 21, 1922

S. LEONARD ROOT. Farmington, Conn. ....M. Feb. 17, 1920

ROBERT J. ROSS. Assistant City Engineer, Municipal Bldg. (Res. 575 New Britain Ave.), Hartford, Conn. ....M. Feb. 9, 1915

GEORGE J. ROSSI. Street Superintendent, Torrington, Conn. Assoc. M. Aug. 14, 1923

HENRY L. ROWLAND. City Engineer's Office, City Hall, Bridgeport, Conn. ....M. Feb. 18, 1919

E. IRVINE RUDD. Chief Engineer, Public Utilities Commission, State Capitol, Hartford (Res. Maple Ave., Glenbrook, Conn.)..M. Aug. 7, 1918

ARTHUR N. RUTHERFORD. Building Inspector, 620 Stanley St., New Britain, Conn. ....Assoc. M. Feb. 18, 1919

E. M. T. RYDER. Way Engineer. Third Avenue Railway System, 3d Ave. and 130th St., New York, N. Y. (Res. 23 Edgecliff Terrace, Yonkers, N. Y.) ....M. Jan. 9, 1900

Sa

GEORGE H. SAGE. President, Berlin Construction Co., Berlin, Conn. (Res. Ledyard Road, Hartford, Conn.) ....M. Jan. 8, 1895

BRYANT F. SARLES. Construction Engineer's Office, care of Connecticut Company (Res. Spring Glen), New Haven, Conn. ...M. Feb. 20, 1923

RICHARD L. SAUNDERS. 603 Penfield Building, Philadelphia, Pa. ....M. Feb. 9, 1909

CALEB M. SAVILLE. Chief Engineer, Board of Water Commissioners, 1026 Main St. (Res. 53 North Beacon St.), Hartford, Conn. ....M. Aug. 12, 1915

ALBERT H. SCHILLING. Contracting Engineer, Berlin Construction Co., Berlin, Conn. (Res. 65 Harrison St., New Britain, Conn.) ....M. Aug. 14, 1906

NEWTON W. SCHWAB. Heating and Sanitary Engineer, 755 Wood Ave., Bridgeport, Conn. ....M. Aug. 14, 1923

THOMAS A. SCOTT. President, The Merritt-Chapman & Scott Corporation, Pequot Ave., New London, Conn. ....M. Aug. 11, 1914

SELDEN P. SEARS. With C. W. Blakeslee & Sons, 58 Waverly St., New Haven, Conn. ....M. Feb. 14, 1912

RAYMOND H. SEGUR. Street Department, 550 Main St. (Res. 77 Oxford St.), Hartford, Conn. ....M. Feb. 20, 1917

PHILIP SELLERS. Architect, 207 Orange St. (Res. 227 McKinley Ave.), New Haven, Conn. ....M. Feb. 9, 1904

WILLIAM J. SELLNER. Office of Construction Engineer, Connecticut Co. (Res. 50 Platt St.), New Haven, Conn. ...Assoc. M. Feb. 17, 1920

SAMUEL P. SENIOR. President, Bridgeport Hydraulic Co., 820 Main St., Bridgeport, Conn. ....M. Feb. 17, 1920

W. H. SHARP. With C. C. Kilby, Inc., Contractors, 43 Farmington Ave., Hartford, Conn. (Res. 986 Farmington Ave., West Hartford, Conn.) ....M. Aug. 11, 1914

JAMES F. SHAUGHNESSY. Asst. Engineer, Board of Water Commissioners (Res. 213 Sargent St.), Hartford, Conn. .....M. Feb. 11, 1902

WILLIAM J. SHAUGHNESSY, JR. General Manager, Eastern Engineering & Construction Co., Bridgeport, Conn. ....Assoc. M. Feb. 17, 1920

PAUL SHELDON. Buck & Sheldon, Inc., Consulting Engineers, P. O. Box 184, Hartford, Conn. ....M. Feb. 12, 1907

EDWARD W. SHEPHERD. Kingston, Pa. ....M. Aug. 11, 1920

BERTON SHOOK. Asst. Engineer, City Engineer's Office, City Hall (Res. 1326 Noble St.), Bridgeport, Conn. ....M. Feb. 15, 1916

CHARLES A. SIBLEY. C. A. Sibley Co., Contracting Engineers, 902 Chapel St., New Haven, Conn. ....M. Feb. 11, 1908

HENRY I. SKILTON. Division Engineer, City Engineer's Office (Res. 103 Allen Place), Hartford, Conn. ....M. Aug. 8, 1917

Sm

RALPH A. SMEAD. Structural Engineer, with Smith, Hinchman & Grylls, Marquette Building (Res. 1443 Taylor Ave.), Detroit, Mich. ....M. Feb. 15, 1916

CHARLES S. SMINCK. The Lawrence Cement Company, 302 Broadway, New York City (Res. Plainfield, N. J.) ....Assoc. M. July 25, 1922

FRANCIS HARVEY SCOTT-SMITH. City Engineer's Office, Waterbury, Conn. (Res. Platts Mills, Naugatuck, Conn.) ....M. Feb. 21, 1922

HERBERT SCOTT-SMITH. City Engineer's Office (Res. 87 White Oak Lane), Waterbury, Conn. ....M. Feb. 21, 1922

L. THEODORE SCOTT-SMITH. La Salle, N. Y. ....M. Feb. 21, 1922

CHARLES E. SMITH. City Engineer's Office, Bridgeport, Conn. (Res Sturges Road, Fairfield, Conn.) ....M. Aug. 14, 1923

FRINK M. SMITH. State Highway Department, 106 Elm St. (Res. 325 Humphrey St.), New Haven, Conn. ....M. Aug. 23, 1905

GEORGE E. SMITH. Division Engineer, State Highway Department, Bank Building, New Milford, Conn. ....M. Feb. 10, 1903

JOHN HENRY SMITH. Division Engineer, State Highway Department, 310 Thayer Bldg., Norwich, Conn. ....M. Feb. 18, 1919

JOHN W. SMITH. Asst. City Engineer, City Hall (Res. R. F. D. No. 1, Box 151), Torrington, Conn. ....M. Feb. 20, 1923

LEWIS L. SMITH. Resident Manager, The Merritt-Chapman & Scott Corp. (Res. 545 Ocean Ave.), New London, Conn.......M. Aug. 11, 1920

RAYMOND W. SMITH. City Engineer's Office, Hartford, Conn. (Res. Tunpis Ave., Bloomfield, Conn.) ....M. Aug. 9, 1921

J. H. SOEHRENS. Valuation Engineer, N. Y., N. H. & H. R. R. (Res. Wallingford, Conn.) ....M. Aug. 10, 1904

NORMAN C. SPENCER. Spencer & Washburn, Civil Engineers, 573 Main St., Hartford, Conn. ....M. Jan. 8, 1901

PAUL B. SPENCER. Engineer of Structures, N. Y., N. H. & H. R. R. (Res. 75 Marvel Road), New Haven, Conn. ....M. Feb. 9, 1915

WALTER T. SPENCER. Superintendent, N. Y., N. H. & H. R. R. South Station, Boston, Mass. (Res. 15 Claflin Road, Brookline, Mass.) ....M. Jan. 9, 1900

A. WILLIAM SPERRY. Sperry Engineering Co., Contractors, 136 Chapel St., New Haven, Conn. ....M. Jan. 9, 1900

JOHN V. SPRAGUE. With The Hudson Paving Co., Contractors, 2875 Broadway, New York, N. Y. ....M. Feb. 11, 1913

St

FREDERICK P. STABELL. Vice President and Secretary, The Samuel W. Hoyt, Jr., Inc., 34 Washington St. (Res. 9 Highland Av.), South Norwalk, Conn. ....M. Feb. 15, 1921

PAUL A. STAHL. With The Berlin Construction Co., Berlin, Conn. (Res. 260 Corbin Ave., New Britain, Conn.) ....M. Aug. 9, 1921

HANS R. STAMM. Architect, The Connecticut Co., 129 Church St., (Res. 1138 Whalley Ave.), New Haven, Conn. ....M. Feb. 21, 1923

MELVIN E. STARK. General Track Supervisor, The Connecticut Co., Bridgeport, Conn. (Res. 3335 Main St., Stratford, Conn.)	M.	Aug. 11, 1914
MARTIN SOMERS STEELMAN. Resident Engineer, Levering & Garrigues, Bristol, Conn. (Res. 73 Vernon St., Hartford, Conn.)	M.	Feb. 15, 1916
LOUIS P. STEIN. City Engineer's Office, City Hall (Res. 89 Ward St.), New Haven, Conn.	M.	Feb. 21, 1922
PAUL STERLING. Asst. to Engineer, M. of W., N. Y., N. H. & H. R. R. Co., New Haven, Conn. (Res. Woodmont, Conn.)	M.	Oct. 11, 1902
ALANSON E. STEWART. Supt. in charge of Jitneys, Public Utilities Commission (Res. 139 Linnmoore St.), Hartford, Conn.	M.	Feb. 10, 1914
EDWARD M. STONE. Architect and Engineer, 327 Trumbull St. (Res. 37 Willard St.), Hartford, Conn.	M.	July 18, 1899
HENRY W. STORRS. With Hart-Hegeman Mfg. Co., 220 Lawrence St. (Res. 122 Clark St.), Hartford, Conn.	M.	Aug. 23, 1905
LUCIUS S. STORRS. President, The Connecticut Company, New Haven, Conn.	M.	Feb. 17, 1920
I. FRANKLIN STORY. Resident Engineer, Waterbury Water Supply (Res. 67 Montgomery St.), Waterbury, Conn.	M.	Aug. 21, 1912
THEODORE R. SUCHER. Asst. Secretary, Asst. Treasurer, New Haven Gas Light Co., 80 Crown St. (Res. "Lucerne," Whitneyville, Conn.), New Haven, Conn.	M.	Feb. 17, 1920
JOHN M. SULLIVAN. Plant Engineer, Whittaker & Glessner Co., 1016 Berwyn Ave., Chicago, Ill.	M.	Aug. 10, 1904
LESLIE G. SUMNER. State Highway Department (Res. 889 Asylum Ave.), Hartford, Conn.	M.	Feb. 17, 1920
GEORGE W. SUNDERLIN. Secretary and Treasurer, The Bridgeport Dredge & Dock Co., General Contractors, Connecticut National Bank Bldg., Bridgeport, Conn.	Assoc. M.	Feb. 14, 1911

T

CHARLES F. TAYLOR. Engineer, State Highway Dept., 12 Washington St., Hartford, Conn. (Res. Windsor, Conn.)	M.	Aug. 12, 1908
GEORGE B. TAYLOR. Designing Engineer, The Berlin Construction Co., Berlin, Conn. (Res. 96 Harrison St., New Britain, Conn.)	M.	Feb. 9, 1915
GEORGE BRITTON TAYLOR. 101 Dwight St., New Haven, Conn.	M.	Feb. 18, 1919
ARTHUR P. TERRILL. With S. E. Minor & Co., Civil Engineers (Res. 154 Mason St.), Greenwich, Conn.	M.	Feb. 20, 1917
ALFRED H. TERRY. Consulting Engineer, 886 Main St., Bridgeport, Conn. (Res. Fairfield, Conn.)	M.	Feb. 11, 1900
RAYMOND E. THAYER. Civil Engineer, The New London Ship & Engine Co. (Res. 90 School St.), New London, Conn.	M.	Feb. 14, 1912
JAMES B. THOMAS. Civil Engineer, 34 Capen St., Hartford, Conn.	M.	Jan. 9, 1900
HENRY J. TIPPET. Division Engineer, The Connecticut Co., 185 Church St. (Res. 235 Central Ave.), New Haven, Conn.	M.	Aug. 8, 1917
JAMES W. TODD. With Fred T. Ley Co., Contractors, New York City	Assoc. M.	Aug. 16, 1910
JAMES A. TONER. Director of Public Works, City Hall (Res. 99 Windsor Ave.), Meriden, Conn.	M.	Aug. 23, 1905
L. EDMUND TOOCKER. With V. B. Clarke, Civil Engineer, Capitol Bldg., Ansonia, Conn. (Res. 20 North St., Milford, Conn.)	M.	Feb. 18, 1919
JOHN F. TOOLE. Bridgeport, Conn.	Assoc. M.	Feb. 14, 1911
JOHN C. TRACY. Professor of Civil Engineering, Yale University (Res. 345 Winthrop Ave.), New Haven, Conn.	M.	Jan. 9, 1900

FRANK M. TRAVIS. Civil Engineer, Torrington, Conn. ....M. Feb. 9, 1915

ELMER E. TRENCH. Civil Engineer, Connecticut Co. (Res. 205 East Grand Ave.), New Haven, Conn. ....M. Feb. 20, 1923

FREDERICK J. TROWBRIDGE. Civil Engineer and Surveyor, 168 Grand St. (Res. 35 Coniston Ave.), Waterbury, Conn. ......M. Feb. 14, 1912

WALTER E. TRUESDELL. Vice President and Secretary, J. H. Wallace & Co., Industrial Engineers, 5 Beekman St., New York City ....M. June 11, 1898

ALBERT M. TURNER. Field Secretary. State Park and Forest Commission, P. O. Drawer 1402 (Res. 68 Buckingham St.), Hartford, Conn. ....M. Aug. 10, 1905

HOMER R. TURNER. Supt. and Engineer, Windsor Water Board, Windsor, Conn. ....M. Feb. 20, 1917

LEON E. TUTTLE. Assistant City Engineer, Town Hall (Res. 3 West Park Place), Stamford, Conn. ....M. Feb. 18, 1919

U

W. LEROY ULRICH. With W. H. Hall Construction Co., 408 Main St. (Res. 101 Ridgefield St.), Hartford, Conn. ....M. Aug. 14, 1913

MAX J. UNKELBACH. Architect and Engineer, 162 Main St. (Res. 75 Black Rock Ave.), New Britain, Conn. ....M. Jan. 9, 1900

V

EDWARD J. VAUGHN. Civil Engineer, with Buck & Sheldon, Inc., 60 Prospect St.. Hartford, Conn. (Res. 38 Lancaster St., West Hartford, Conn.) ....M. Feb. 15, 1916

GEORGE E. VERRILL. 1648 Whitney Ave., Route 101, New Haven, Conn. ....M. Feb. 11, 1902

W

JOSEPH PALMER WADHAMS. Asst. Engineer, Public Utilities Commission, Hartford, Conn. (Res. 1584 Chapel St., New Haven, Conn.) ....M. Feb. 9, 1904

M. ALLYN WADHAMS. 79 Lawrence Ave., New Brunswick, N. J. ....M. Feb. 19, 1918

WILLIAM E. WALLER. Box 229, Chestnut Hill, R. F. D. No. 1, Bridgeport, Conn. ....M. Feb. 9, 1915

VIRGIL E. WARDWELL. The F. S. Wardwell Co., P. O. Box 145, Stamford, Conn. ....M. Feb. 15, 1921

CHARLES P. WATERMAN. President and Treasurer, Charles P. Waterman, Inc., 43 Farmington Ave. (Res. 118 Warrenton Ave.), Hartford, Conn. ....M. Feb. 11, 1908

IRVILLE D. WATERMAN. Construction Engineer, N. Y., N. H. & H. R. R. Co., New Haven, Conn. ....M. Feb. 19, 1918

KENNETH WATROUS. Civil Engineer, Box 23, Groton, Conn. ....M. Feb. 14, 1911

EDMUND B. WATSON. Sunderland & Watson, Architects, 98 Park Ave., Danbury, Conn. ....M. Aug. 11, 1914

WILLIAM C. WATSON. Bridge Dept., N. Y., N. H. & H. R. R., New Haven (Res. 45 Smith St., West Haven, Conn.) ....M. Feb. 17, 1920

GEORGE E. WATTERS. Civil Engineer, City Sewer and Water Works, P. O. Box 327, New London, Conn. ....M. Feb. 14, 1911

D. J. HENRY WEBB. Vice President and General Manager, Conn. National Pavements, Inc., 173 Orange St. (Res. 30 Ardmore St., Spring Glen Manor), New Haven, Conn. ....M. Aug. 7, 1918

ERNEST C. WEBSTER. With C. C. Kilby, Inc., Contractors, 43 Farmington Ave., Hartford, Conn. ....M. Aug. 14, 1923

ELMER C. WELDEN. Deputy State Highway Commissioner, Hartford, Conn. ....M. Feb. 18, 1919

ALEXANDER M. WELLINGTON. City Engineer's Office, New Haven, Conn. ....M. Feb. 17, 1920

ALDEN WELLS. Dept. of Engineering, Municipal Building (Res. 40 Freeman St.), Hartford, Conn. ....M. Feb. 15, 1910

CHARLES A. WHEELER. Professor of Mathematics and Engineering, Conn. Agricultural College, Storrs, Conn. ....M. Jan. 8, 1901

RALPH A. WHEELER. Civil Engineer, Oakville Co., Waterbury, Conn. (Res. Oakville, Conn.) ....M. Feb. 21, 1922

HENRY C. WHITLOCK. Asst. Engineer, City Engineer's Office, Waterbury, Conn. (Res. 157 High St., Naugatuck, Conn.)....M. Feb. 12, 1922

ELI WHITNEY. President, New Haven Water Company (Res. 800 Whitney Ave.), New Haven, Conn. ....M. Mar. 30, 1900

STEPHEN WHITNEY. Secretary and Treasurer, Connecticut National Pavements, Inc., 173 Orange St., New Haven, Conn. ....Assoc. M. Aug. 11, 1920

FRANK W. WHITON. Whiton & McMahon, Architects, 36 Pearl St., Hartford, Conn. ....Assoc. M. Feb. 14, 1905

J. B. WHITTMORE. Cost Engineer, N. Y., N. H. & H. R. R., Danbury Div., P. O. Box 661, Danbury, Conn. ....M. Feb. 9, 1915

ERNEST W. WIGGIN. Consulting Engineer, 113 Church St. (Res. 250 West Rock Ave.) New Haven, Conn. ....M. Mar. 30, 1900

HERBERT B. WIGHTMAN. Civil Engineer, 114 Thayer Bldg. (Res. 1 Elmwood Ave.), Norwich, Conn. ....M. Aug. 16, 1910

HARRY T. WILLIAMS. Civil Engineer, 1772 East Main St., Waterbury, Conn. ....M. Aug. 12, 1915

JOHN C. WILLIAMS. City Engineer, Town Hall (Res. 18 West Park Place), Stamford, Conn. ....M. Feb. 18, 1910

JOSEPH D. WILLIAMS. City Engineer, 206 City Hall (Res. 54 Garden St.), New Britain, Conn. ....M. Feb. 15, 1916

PHILIP K. WILLIAMS. With J. B. Williams Co., Glastonbury, Conn. ....M. Aug. 14, 1906

JOHN F. WILLIS. Civil Engineer, 12 Washington St., Hartford, Conn. ....M. July 25, 1922

P. NEY WILSON. Montauk Apartment, Ocean Ave., Brooklyn, N. Y. ....M. Aug. 14, 1913

C.-E. A. WINSLOW. Professor of Public Health, Yale University (Res. 121 Whitney Ave.), New Haven, Conn. ....M. Aug. 8, 1916

HENRY A. WOLCOTT. Mechanical and Civil Engineer, West Hartford, Conn. ....M. July 18, 1899

WILLIAM J. WOOD, JR. Plant Engineer, The F. S. Wardwell Co., Westport, Conn. ....M. Feb. 21, 1922

JOHN J. WOODS. Civil Engineer, Baltic, Conn. ....M. Feb. 10, 1914

ALBERT LOUIS WORTHEN. Supt., The Connecticut Quarries Co., Drawer 1849 (Res. 56 Alden Ave.), New Haven, Conn. ......M. Feb. 15, 1916

GEORGE E. WRIGHT. Asst. City Engineer, City Hall (Res. 78 West 8th Ave), Gloversville, N. Y. ....M. Feb. 17, 1920

F. WALDEN WRIGHT. Town Engineer, Hamden, Conn. ......M. Aug. 12, 1908

HAROLD G. WYNNE. City Engineer's Office, New Haven, Conn. ....M. Feb. 17, 1920

Y

GUILFORD D. YOUNG. Asst. Construction Engineer, The Connecticut Co., 129 Church St., New Haven, Conn. (Res. 271 Elm St., West Haven, Conn.) ....M. Feb. 20, 1917

Geographical List of Members

Names are usually arranged under place of business

CONNECTICUT

Fairfield County

Bridgeport—H. W. Barlow, A. M. Beardsley, H. L. Beers, F. L. Black, E. L. Dargan, T. DeForest (Assoc. M.), H. C. Elton, L. E. Evans, A. D. Fuller, C. B. Hamill, F. B. Hastings (Assoc. M.), W. S. Hewlett (Assoc. M.), F. B. Jaynes, H. W. Kenyon, J. A. McElroy, F. J. Murphy (Assoc. M.), W. B. Palmer (Hon. M.), B. D. Pierce, Jr., H. L. Rowland, N. W. Schwab, S. P. Senior, W. J. Shaughnessy, Jr. (Assoc. M.), B. Shook, C. E. Smith, M. E. Stark, G. W. Sunderlin (Assoc. M.), A. H. Terry, J. F. Toole (Assoc. M.), W. E. Waller.

Danbury—C. O. Brown, H. S. Osborn, E. B. Watson, J. B. Whittmore.

East Norwalk—R. D. Haven.

Glenbrook—E. I. Rudd.

Greenwich—J. W. Cone, P. L. Minor, S. E. Minor, A. P. Terrill.

South Norwalk—D. B. Eula, S. W. Hoyt, Jr., C. S. Maschal (Assoc. M.), F. P. Stabell.

Stamford—G. D. Arthur, W. H. Arthur, E. H. Beard, S. N. Clarke, C. A. Hatch (Assoc. M.), P. Nash, H. A. Parsons, L. E. Tuttle, V. E. Wardwell, J. C. Williams.

Westport—W. J. Wood, Jr.

Hartford County

Berlin—C. B. Baldwin, J. E. Boylan, C. F. Chase, W. H. Fitzell (Assoc. M.), J. T. Hart, C. W. Heusted (Assoc. M.), F. G. Patience, J. P. Quay, G. H. Sage, A. H. Schilling, P. A. Stahl, G. B. Taylor.

Bristol—C. W. Buell, C. M. Pfennig, M. S. Steelman.

East Hartford—L. B. Comstock, C. F. Gifford, C. H. Olmsted.

Farmington—S. L. Root.

Glastonbury—P. K. Williams.

Hartford—A. B. Alderson, S. J. Bagley (Assoc. M.), B. W. Bartlett, C. E. Beach, C. J. Bennett, F. S. Brainard, W. H. Brainard, W. S. Brewer, C. M. Broderick, H. R. Buck, L. H. Burt, E. W. Bush, H. B. Bussing, Jr., D. H. Cannon, H. G. Clark, R. W. Clark, W. A. Clinton, F. P. Close, C. L. Cole, A. D. Colvin, H. M. Connelly, M. A. Connor, C. W. Cooke, J. Craig, R. E. Cross, R. E. Curtiss, G. W. Dean, W. W. DeMay, J. Doman, E. L. Donaghue, F. H. Ellsworth, W. J. Ennis, A. Fien, F. G. Flood, G. S. Francis, R. F. Gadd, E. S. Geer, E. D. Graves, C. E. Green, A. H. Greenwood, G. E. Hamlin, J. T. Henderson, J. H. Hendry, C. E. Hubbard (Assoc. M.), C. V. Johnson, W. D. Johnson, W. E. Johnson, R. E. Kelley, C. C. Kilby, P. P. Kimball, F. S. Luther (Hon. M.), J. A. MacDonald, E. P. Manville, R. H. Mather, F. P. McKaig, G. L. Mylchreest, T. F. Neuhaus, J. A. Newlands, R. C. Noerr, H. B. Olmsted, G. A. Parker, E. M. Peck, L. F. Peck, G. W. Penfield, H. D. Pomeroy, S. C. Poriss, P. K. Rask, M. E. Reid, S. N. Robinson, C. E. Rogers, J. B. Root, R. J. Ross, C. M. Saville, R. H. Segur, W. H. Sharp, J. F. Shaughnessy, P. Sheldon, H. I. Skilton, R. W. Smith, N. C. Spencer, A. E. Stewart, E. M. Stone, H. W. Storrs, L. G. Sumner, C. F. Taylor, J. B. Thomas, A. M. Turner, W. L. Ulrich, E. J. Vaughn, C. P. Waterman, E. C. Webster, E. C. Welden, A. Wells, F. W. Whiton (Assoc. M.), J. F. Willis.

Manchester—J. F. Bowen.

New Britain—A. W. Bacon, C. E. Bloom, W. H. Cadwell, R. B. Doane, G. M. Gearhart, W. H. Hall, F. H. Johnson, P. A. Merian, A. H. Rice (Assoc. M.), A. W. Rice (Hon. M.), A. N. Rutherford (Assoc. M.), M. J. Unklebach, J. D. Williams.

Rockwell—G. B. Keeny.

SOUTH MANCHESTER—E. L. G. Hohenthal, Jr.

SOUTHINGTON—F. J. Hurley, E. H. Lotz, S. H. MacKenzie.

WEST HARTFORD—E. B. Barker, J. W. Holden, H. L. Nickels, H. A. Wolcott.

WINDSOR—H. R. Turner.

Litchfield County

CANAAN—W. W. Burghardt, A. W. Herbst (Assoc. M.), H. E. Lyles.

COLLINSVILLE—A. H. Codaire, G. A. Knight.

KENT—A. McDowell.

NEW MILFORD—W. M. Jones, E. S. Lawler, G. E. Smith.

SALISBURY—W. E. Pettee (Hon. M.)

TORRINGTON—H. G. Brothwell, W. J. Fritz, I. B. Holley (Assoc. M.), W. C. Kruser, C. A. Miller, C. H. Nickerson, W. F. Nierintz, C. A. Patterson, G. J. Rossi (Assoc. (M.), J. W. Smith, F. M. Travis.

WATERTOWN—B. E. Lockwood.

WINSTED—R. S. Hulbert (Hon. M.), D. C. Loewe.

Middlesex County

GILDERSLEEVE—O. Gildersleeve.

MIDDLETOWN—E. P. Augur (Hon. M.), C. A. Campbell, L. N. Germain, J. M. Lannan, E. A. McCarthy, E. T. McDowell, J. W. Mylchreest, L. F. Quirk.

PORTLAND—F. DePeyster.

New Haven County

ANSONIA—W. J. Blatchley, V. B. Clarke, F. J. Davis, A. B. Mills, M. B. Nichols, L. E. Toocker.

BRANFORD—J. W. Phelps.

CHESHIRE—E. J. Beugler.

DERBY—D. E. Brinsmade.

HAMDEN—L. S. Day, C. H. Lindsey, F. W. Wright.

MERIDEN—W. T. Arnold, G. P. Barker, F. R. Bartlett, R. N. R. Chaffee, W. S. Clark, H. E. Daggett, F. H. Edwards (Assoc. M.), H. D. Immick, M. B. Lewis, Jr., A. F. Morehouse (Assoc. M.), E. B. Moss, J. W. Phillips, C. P. Prann, W. Robinson (Assoc. M.), J. A. Toner.

NAUGATUCK—C. D. Curtis, G. C. Ham.

NEW HAVEN—G. X. Amryhn (Assoc. M.), N. Ayman, W. J. Backes, D. S. Banta, S. E. Barney, W. V. Barry, C. L. Beeler, H. K. Bein, C. T. Bishop, C. M. Blair, A. D. Blakeslee, C. Blakeslee, H. L. Blakeslee, M. G. Blakeslee, W. M. Bolton, C. A. Bowman, L. P. Breckinridge (Hon. M.), R. J. Brenner, J. T. Brosnan, C. B. Brown, R. C. Brown, H. T. Burgess, A. W. Bushell, A. Cahn, W. J. Carew, F. J. Carey (Assoc. M.), H. E. Carlisle, L. J. Carmalt, R. H. Chittenden (Hon. M.), A. L. Clark, J. H. F. Clark, C. H. Clements, E. E. Clough, F. L. Coe, A. L. Curtis, J. F. Degnan (Assoc. M.), A. L. Donnelly, W. T. Dorrance, F. J. Easterbrook, J. N. Eckle, C. C. Elwell, E. H. Everit, C. S. Farnham, C. A. Ferry, E. P. Fitzgerald, F. L. Ford, J. L. Frech, E. Gagel, D. F. Gailor, W. T. Gilbert, C. A. Giordano, H. H. Gladding, L. E. Guyott, A. T. Hadley (Hon. M.), C. D. Hanover, Jr., C. R. Harte, A. S. Hawley, G. A. Hellwig, A. B. Hill, C. G. H. Holbrook, R. M. Hosley, H. G. Husted, J. F. Jackson, J. F. Johnson, M. M. Johnston, H. J. Kellogg (Hon. M.), J. O. Kelly, P. J. Kelly (Assoc. M.), G. R. Kent, R. S. Kirby, C. A. Knox, J. J. Lane (Assoc. M.), P. G. Laurson, K. W. Leighton, C. T. Lyon, W. P. MacKenzie, G. H. MacLean, G. V. Maconi, C. A. Magill, O. H. Marchant, T. P. McCluskey, H. S. McIntosh, B. A. Mehls, Jr., C. W. Merrels, C. J. Messier, E. E. Minor, C. A. Munson, E. S. Nettleton, E. J. Pearson, L. M. Petrucelli, H. E. Phelps, F. J. Pitcher, E. W. Poland, R. W. Prann, C. E. Price, J. K. Punderford, J. S. Randle, J. H. Rapuano, R. J. Reigeluth, R. H. Rich, R. M. Robinson, B. F. Sarles, S. P. Sears, P. Sellers, W. J. Sellner (Assoc. M.), C. A. Sibley, F. M. Smith, J. H. Soehrens, A. W. Sperry, P. B. Spencer, H. R. Stamm, L. P. Stein, P. Sterling, L. S. Storrs, T. R. Sucher, G. B. Taylor, H. J. Tippett, J. C. Tracy, E. E. Trench, G. E. Verrill, J. P. Wadhams, I. D. Waterman, W. C. Watson, D. J. H. Webb, A. M. Wellington, E. Whitney, S. Whitney (Assoc. M.), E. W. Wiggin, C.-E. A. Winslow, A. L. Worthen, H. G. Wynne, G. D. Young.

NORTH HAVEN—G. B. Lewis.

WALLINGFORD—J. H. Child, W. A. MacKenzie.

WATERBURY—E. W. Benedict, R. J. Bieth, J. J. Brady, G. E. Browne, R. A. Cairns, C. H. Chapman (Assoc. M.), E. H. D. Christofferson, R. W. Clark, W. E. Colby, A. P. Colgan, T. M. Curry, Jr., J. H. Doerr, C. W. Eddy, H. W. Fritz (Assoc. M.), E. O. Goss, W. P. Green, I. W. Harrison, E. C. Hollis, F. Ineson, R. B. Kirchberger, J. H. Lauper, D. G. Little, T. D. McCarthy (Assoc. M.), H. B. McCrone, C. E. McDonald, G. N. McDonald, I. C. Miller, R. I. Minnaman, F. J. Monaghan, L. R. Newhall, A. J. Patton, C. H. Preston, C. P. Richmond, C. A. Root, W. G. Smith (Hon. M.), F. H. Scott-Smith, H. Scott-Smith, I. F. Story, F. J. Trowbridge, R. A. Wheeler, H. C. Whitlock, H. T. Williams.

WATERVILLE—T. W. Beard.

WEST HAVEN—A. S. Lynch.

New London County

BALTIC—J. J. Woods.

GROTON—E. C. Daboll, H. L. Prentiss, K. Watrous.

NEW LONDON—J. E. Barlow, G. L. Bilderbeck, S. A. Bittner, W. E. Clarke, E. T. Collins, G. K. Crandall, L. E. Daboll, C. R. Darrow, H. L. Dunn, W. A. Fones (Assoc. M.), R. S. Gardner, W. H. Hull, F. W. LaForge (Hon. M.), F. S. Langdon, A. F. Mix, M B. Payne, T. A. Scott, L. L. Smith, R. E. Thayer, G. E. Watters.

NORWICH—C. E. Chandler (Hon. M.), J. H. French, H. D. Larabee, S. B. Palmer, J. H. Smith, H. B. Wightman.

Tolland County

ELLINGTON—J. T. McKnight.

STORRS—C. A. Wheeler.

Windham County

WILLIMANTIC—J. F. Collins, J. F. Doonan, R. E. Mitchell.

CALIFORNIA

EAGLE ROCK—W. B. Fuller (Hon. M.).

LOS ANGELES—H. N. Hymen.

COLORADO

ROLLINSVILLE—R. B. Miller.

ILLINOIS

CHICAGO—F. E. Caldwell, J. M. Sullivan.

MAINE

PORTLAND—F. W. Howard.

MASSACHUSETTS

BOSTON—F. S. Curtiss, J. M. Duffy (Assoc. M.), W. F. Hickey (Assoc. M.), D. A. Kennedy (Assoc. M.), R. C. Meeker, H. H. Murray, L. Reed, H. L. Ripley, W. T. Spencer.

BROOKLINE—D. Fitzgerald (Hon. M.).

LOWELL—E. C. Haynes (Hon. M.).

PITTSFIELD—R. J. Andrews.

QUINCY—E. LeR. Lane.

SPRINGFIELD—H. C. Collins, R. G. Inge (Assoc. M.), E. E. Lochridge.

WEST SPRINGFIELD—H. T. Murphy.

MICHIGAN

DETROIT—W. R. Dunham, Jr., R. A. Smead.

NEW HAMPSHIRE

CONCORD—O. W. Head.

NEW JERSEY

Newark—R. B. Azhderian.

New Brunswick—M. A. Wadhams.

NEW YORK

Brooklyn—A. Burros, R. C. Cram, P. N. Wilson.

Gloversville—G. E. Wright.

La Salle—L. T. Scott-Smith.

Locust Valley—A. J. Hans.

Mount Vernon—W. Halton (Assoc. M.).

New York City—G. B. Allen, W. H. Barker, C. A. Beckley, D. Bonner, Jr., A. G. Bouton, F. R. Bryant (Assoc. M.), E. Burger, E. C. Buschor, T. I. Coe, A. L. Davis, C. F. Gailor, C. E. Hall, H. C. Keith, A. B. Moxter, G. A. Orrok, E. M. T. Ryder, F. W. Skinner (Hon. M.), C. S. Sminck (Assoc. M.), J. V. Sprague, J. W. Todd (Assoc. M.), W. E. Truesdell.

Port Chester—M. Merritt.

Saratoga Springs—J. L. Gregory.

Utica—R. J. Brown.

OHIO

Cleveland—J. J. Kerr (Assoc. M.).

Dayton—C. R. Deming.

OREGON

Salem—A. M. MacKenzie.

PENNSYLVANIA

Altoona—W. A. Jones.

Cynwyd—L. M. Haupt (Hon. M.).

Kingston—E. W. Shepherd.

Philadelphia—R. W. Parkhurst, R. L. Saunders.

RHODE ISLAND

Providence—E. W. Crawley, E. F. Durfee, W. H. Law.

Westerly—T. McKenzie.

THE PROCEEDINGS

of the

Connecticut Society *of* Civil Engineers, Inc.

is an annual publication, containing papers read at the meetings, together with reports of business transacted. The papers are prepared not only by its own members, but also by other engineers of large experience. This publication forms a valuable addition to any engineering library. ALL MEMBERS OF THE SOCIETY RECEIVE THE PROCEEDINGS IN PART RETURN FOR THEIR DUES; to all others the price is $1.50.

PATRONIZE OUR ADVERTISERS

(They are all reliable)

Please mention this publication in addressing them

To ADVERTISERS

The attention of contractors, engineers and parties dealing in machinery, construction materials and engineering equipment, is called to this publication as an excellent advertising medium.

This publication reaches practically all engineers and contractors in Connecticut, and also some in other States. The total issue is 750 copies.

The Proceedings are preserved by the members and constantly referred to by them, and advertisers are thus more certain to reach customers.

The Proceedings are not published as a means of revenue, advertisements being inserted solely to help meet the large expense of publication.

ADVERTISING RATES

Full page	Ten dollars
Half page	Seven dollars
Quarter page	Four dollars

A sample copy will be sent on application.
The next issue will be about Oct. 1, 1924.
For further information, address

THE SECRETARY
P. O. BOX 235
NEW HAVEN, CONN.

ALPHABETICAL LIST OF ADVERTISERS

CLASSIFIED LIST OF ADVERTISERS
